SOIL SURVEY OF
UVALDE COUNTY, TEXAS

ELECTRONIC VERSION

This soil survey is an electronic version of the original printed copy. It has been formatted for electronic delivery. Additional and updated information may be available from the Web Soil Survey. In Web Soil Survey, identify an Area of Interest (AOI) and navigate through the AOI Properties panel to learn what soil data is available.

United States Department of Agriculture
Soil Conservation Service
In cooperation with
Texas Agricultural Experiment Station

Major fieldwork for this soil survey was completed in the period 1961-69. Soil names and descriptions were approved in 1970. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1969. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Nueces-Frio-Sabinal Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250

HOW TO USE THIS SOIL SURVEY

This soil survey contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in determining the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Uvalde County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside, and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification, pasture and hayland group, and range site of each. It also shows the page where each soil is described and the page for the capability units, the range site, and the pasture and hayland group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green; those that have a moderate limitation can be colored yellow; and those that have a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the range sites.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range and also the names of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for nonindustrial buildings and for recreation areas in the section "Use of the Soils in Engineering."

Engineers and builders can find, under "Use of the Soils in Engineering," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomer in Uvalde County will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication.

Cover: Santa Gertrudis cattle grazing in a pasture of plains bristlegrass and blue panicgrass on a Montell clay.

Contents

SOIL SURVEY OF UVALDE COUNTY, TEXAS

BY JACK W. STEVENS AND DAVIE L. RICHMOND, SOIL CONSERVATION SERVICE
Assisted by ADRIAN PARMETER, DALE MELIUS, EDGAR ENSY ARVID MELAND while on winter detail from South Dakota.
UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

UVALDE COUNTY is square in shape and covers 1,588 square miles, or 1,016,320 acres, and it is in southwestern Texas (fig. 1). It is bordered on the south by Zavala County, on the west by Kinney County, on the east by Medina County, and on the north by Bandera, Edwards, and Real Counties. Uvalde, the county seat, is 82 miles west of San Antonio, 70 miles east of Del Rio, and 134 miles north of Laredo. Other major towns in the county are Knippa, Sabinal, and Utopia. Smaller communities are Blewett, Cline, Concan, Montell, and Reagan Wells.

Figure 1.—Location of Uvalde County in Texas.

Two U.S. highways cross the county—U.S. Highway 90 from east to west and U.S. Highway 83 from north to south. Both of these highways pass through Uvalde. Texas Highway 55 begins at Uvalde and goes northwest, and Texas Highway 127 connects Sabinal and Concan. Several farm roads transect the county.

The Southern Pacific Railroad crosses the county from east to west, and the Missouri Pacific Railroad enters the county in the southwest corner and goes to the asphalt mines near Blewett.

The major streams of the county are the West Nueces and Nueces Rivers, the Dry Frio and Frio Rivers, the Sabinal and Leona Rivers, and Blanco Creek. All flow in a southerly or southeasterly direction from the Edwards Plateau part of the county.

Asphalt is mined in the southwestern part of the county near Blewett. Traprock, a hard basaltic material, is mined at Knippa in the eastern sector of the county. Some

exploration for oil and gas is in progress. Although very few productive oil wells have been discovered, a few productive gas wells are in operation.

Farming and ranching are the major enterprises in the county. About 886,320 acres are used for raising beef cattle, sheep, and goats. Approximately 130,000 acres are cultivated. About 30,000 acres of this is irrigated, but the local trend is toward increased usage of irrigation. Dryland farming is devoted mainly to grain sorghums, small grains, and adapted pasture grasses. Where soils are irrigated, these same crops and many kinds of truck crops, such as winter vegetables, are grown. Most of the cultivated acreage, both dryland and irrigated, is in the Sabinal, Knippa, and Uvalde areas.

Deep wells are the primary sources of irrigation water. Most of the wells draw on the underground water strata in the Edwards Limestone Formation and in the Leona Formation, both of which yield good-quality irrigation water.

Wildlife is an important resource in the county. The leasing of land for hunting is an important source of income for many landowners.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Uvalde County, where they are located, and how they can be used. The soil scientists went into the county knowing they would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Knippa and Uvalde, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Knippa clay, 0 to 1 percent slopes, is one of several phases within the Knippa series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Uvalde County: soil complexes, soil associations, and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Eckrant-Kavett complex, 0 to 5 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Rock land-Real association, steep, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by “and.” Real and Eckrant soils, undulating, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rock land is a land type in this county.

While a soil survey is in progress, samples of soil are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places also are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used both as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or to depth of soil to bedrock. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Uvalde County. A soil association is a landscape that has a distinctive

proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not suitable for planning the management of a farm or field, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The six soil associations in Uvalde County, which are shown on the colored map at the back of this survey, are described in this section.

1. Uvalde-Knippa-Montell association

Nearly level to gently sloping, deep loamy and clayey soils

This association consists of nearly level and gently sloping, deep, moderately permeable to very slowly permeable soils. These soils are in broad, smooth areas and broad valleys. Slopes range from 0 to 3 percent, but are mainly less than 1 percent.

This association makes up about 35 percent of the county. Uvalde soils account for about 30 percent of the association, Knippa soils 27 percent, and Montell soils 12 percent (fig. 2). The remaining 31 percent is less extensive areas of Atco, Caid, Castroville, Conalb, Dant, Dev, Frio, Ingram, Mercedes, Orif, Ramadero, Sabenyo, Tobosa, and Valco soils.

Uvalde soils have a dark-brown silty clay loam surface layer about 16 inches thick. The next layer is silty clay loam that is brown in the upper 19 inches and very

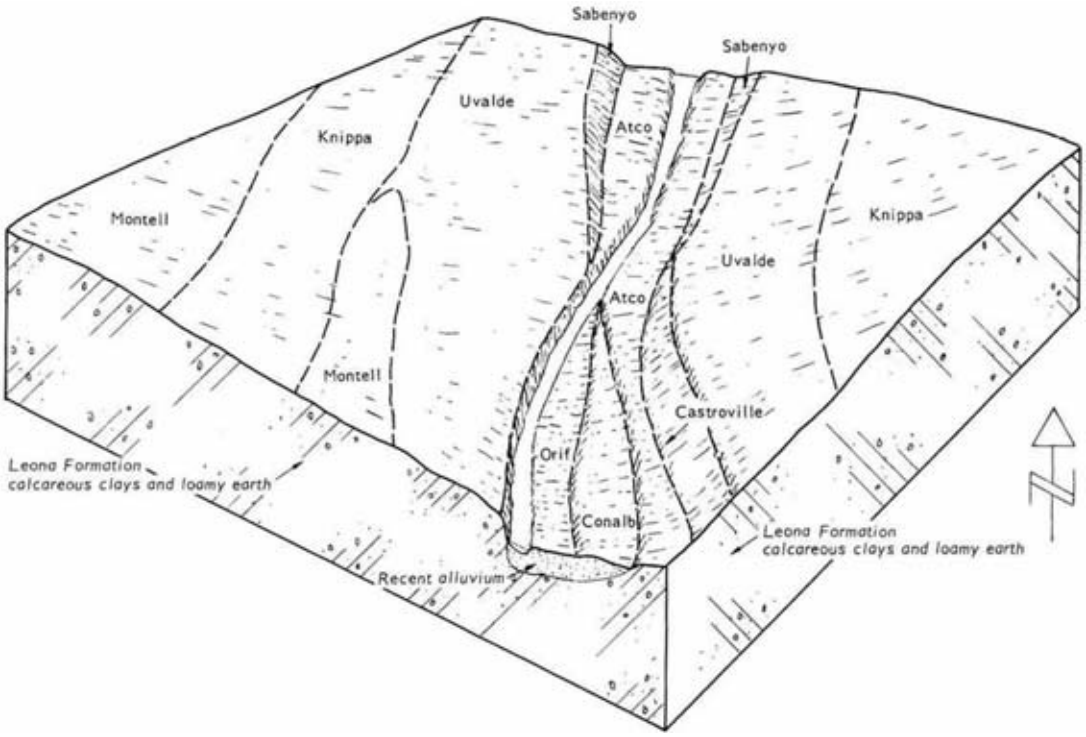

Figure 2.—Representative pattern of soils in the Uvalde-Knippa-Montell association.

pale brown in the lower 17 inches. The underlying material to a depth of 80 inches is very pale brown silty clay loam.

Knippa soils have a clay surface layer about 18 inches thick. It is dark grayish brown in the upper part and brown in the lower part. The next layer, extending to a depth of 35 inches, is clay that is reddish brown in the upper part and brown in the lower part. The underlying material to a depth of 60 inches is clay loam. It is light brown in the upper 13 inches and pink in the lower 12 inches.

Montell soils have a gray clay surface layer about 32 inches thick. The next layer is clay that is grayish brown in the upper 16 inches and light brownish gray in the lower 10 inches. The underlying material to a depth of 72 inches is very pale brown clay.

About 32 percent of this association is cultivated, and of this, about 25 percent is irrigated. The major soils are well suited to many kinds of irrigated crops and to some dryland crops.

The other 68 percent of the association is in range or is used as wildlife habitat. The range is easily accessible to cattle. Sheep and goats also are common. Under good management, an abundance of grasses, forbs, and shrubs can be produced on the soils of this association, but much thorny brush has invaded the area. Deer, turkey, quail, dove, and other wildlife are abundant. Farm ponds scattered throughout the area provide fishing and other recreation.

2. Rock land-Real-Eckrant association

Exposed limestone bedrock and nearly level to gently sloping and undulating to steep, shallow to very shallow and gravelly, loamy and clayey soils

This association is nearly level to gently sloping and undulating to steep and broken. In many places, it is deeply dissected by canyons that have nearly vertical walls. In most places, slopes range from 20 to 45 percent. In a few places, such as in the narrow valleys between the steeper hills or on the narrow caps of the hills, slopes range from about 2 to 20 percent. Exposed limestone bedrock is common in much of the association. Boulders, stones, and cobblestones are common in the areas between bedrock exposures.

This association accounts for about 25 percent of the county. Rock land makes up about 40 percent of the association, Real soils 18 percent, and Eckrant soils 12 percent (fig. 3). The remaining 30 percent is less extensive areas of Brackett, Dev, Ector, Kavett, Orif, Pratley, San Saba, and Speck soils.

The Rock land areas are exposures of limestone bedrock that are fractured in place, and some of these fractures are filled with soil material. In places a thin mantle, less than 2 inches thick, of dark soil material overlies the bedrock.

In the Rock land-Real part of this association, Rock land occurs as a thick limestone mantle that caps the hills. In the Limestone rock land part, it occurs as irregular and discontinuous bands that are about 10 to 50 feet wide and extend on the contour around the hills. These bands are about 10 to 50 feet apart.

Real soils have a dark grayish-brown gravelly clay loam surface layer about 6 inches thick. The next layer is dark grayish-brown very gravelly clay loam about 7 inches thick. The underlying material is weakly cemented limestone.

Eckrant soils have a very dark gray gravelly clay surface layer about 12 inches thick. The underlying material is coarsely fractured indurated limestone bedrock.

The soils of this association are used as range and wildlife habitat. They are not suited to cultivation. The rough, rocky terrain is more easily accessible to goats and sheep than to cattle. Most ranches, however, have a few cattle. Many kinds of grasses, forbs, and shrubs provide palatable food for sheep and goats and for wildlife.

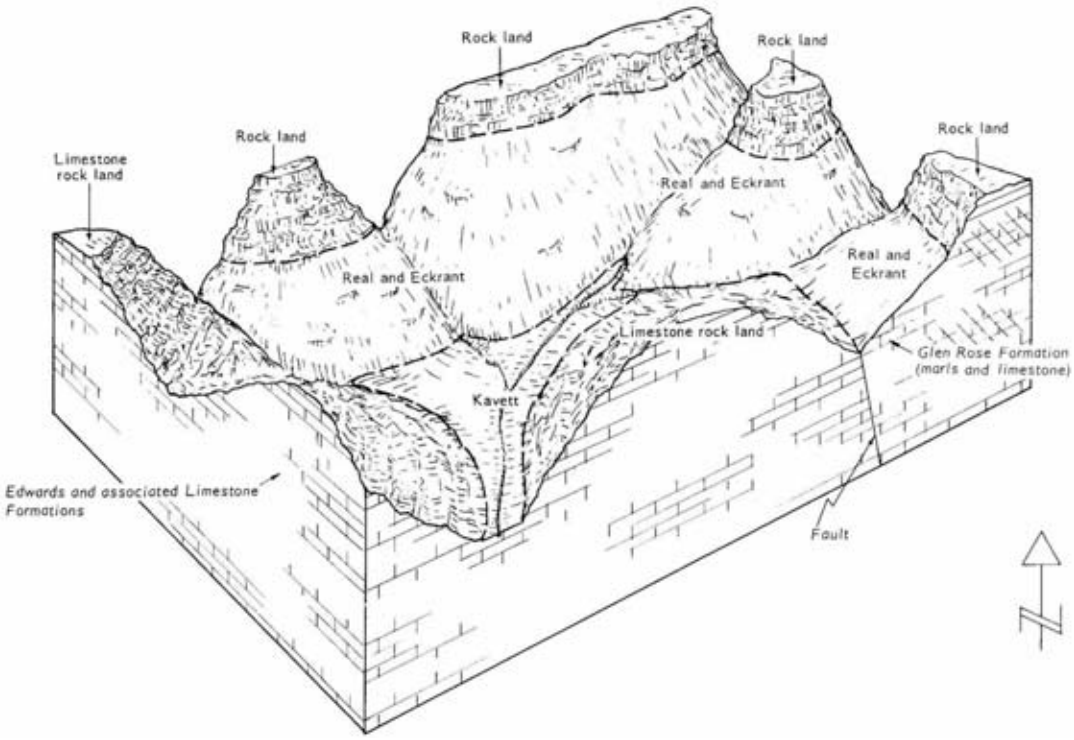

Figure 3.—Representative pattern of soils in the Rock land Real-Eckrant association.

This association is well stocked with deer, and many areas are managed by ranchers for hunting. The canyons provide many scenic spots, some of which can be reached by automobile and others only on horseback.

Limestone is quarried in some places for roadbuilding material.

3. Ector-Eckrant-Speck association

Nearly level to gently sloping and undulating to hilly, very shallow to shallow and stony, clayey and loamy soils

This association accounts for about 23 percent of the county. Ector soils make up about 31 percent of the association, Eckrant soils about 18 percent, and Speck soils about 11 percent (fig. 4). The other 40 percent is less extensive areas of Brackett, Castroville, Dev, Frio, Kavett, Orif, Pratley, San Saba, Tobosa, Topia, Uvalde, and Volente soils and Limestone rock land.

Ector soils have a very dark grayish-brown cobbly clay loam surface layer about 15 inches thick. Below this is indurated fractured limestone bedrock.

Eckrant soils have a very dark gray gravelly clay surface layer about 12 inches thick. Below this is in durated fractured limestone bedrock.

Speck soils have a very dark grayish-brown clay surface layer about 8 inches thick. The next layer, extending to a depth of 17 inches, is reddish-brown clay. Below this is limestone bedrock.

Limestone stones, cobblestones and gravel are on the surface and throughout all of the major soils.

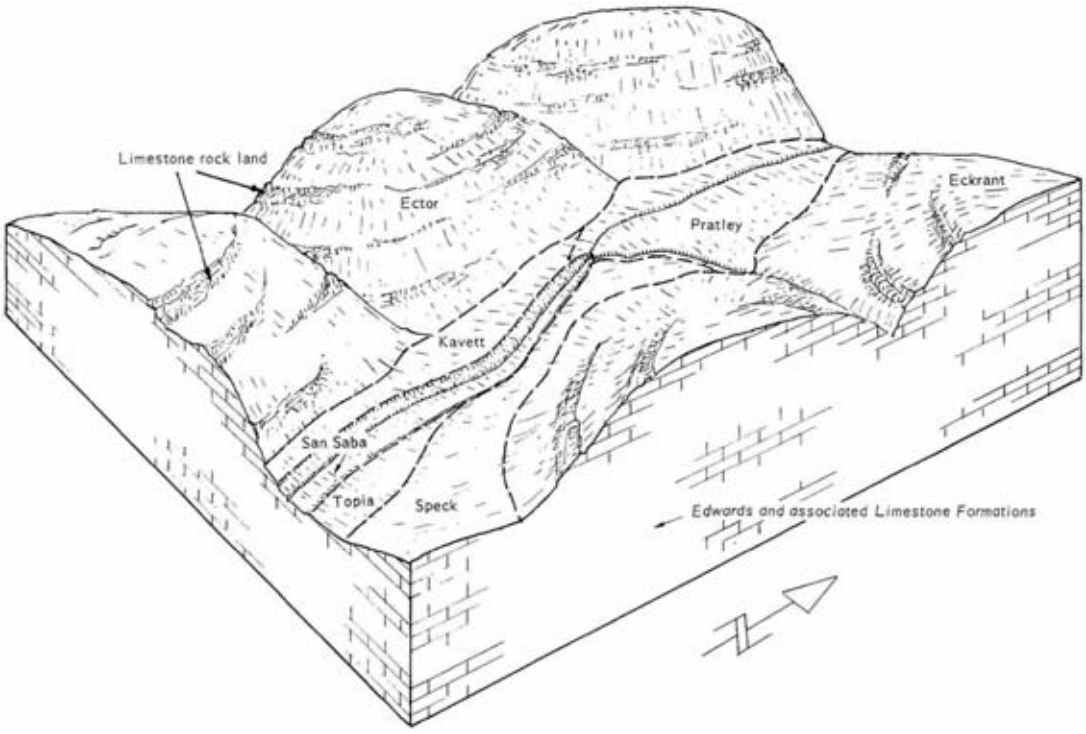

Figure 4.—Representative pattern of soils in the Ector-Eckrant-Speck association.

The soils of this association are used mainly as range and wildlife habitat. A few small, isolated areas of deep soil are cultivated, but most of this association is poorly suited to cultivation. Many kinds of grasses, forbs, and shrubs provide palatable food for both livestock, chiefly sheep, goats, and cattle, and for wildlife. This association is well stocked with deer and turkey, and many areas are managed by ranchers for hunting.

4. Olmos-Ector association

Undulating, shallow and very shallow and stony and gravelly, loamy soils

This association makes up about 10 percent of the county (fig. 5). Olmos soils account for about 54 percent of the association, and Ector soils about 23 percent. The remaining 23 percent is less extensive areas of Ingram, Knippa, Montell, Randado, Rehm, Uvalde, Valco, and Zapata soils.

Olmos soils have a dark grayish-brown gravelly loam surface layer about 13 inches thick. The underlying material is caliche that is indurated in the upper 1 inch.

Ector soils have a very dark grayish-brown very gravelly loam surface layer about 9 inches thick that is 10 percent limestone fragments. A few stones are on the surface. Below this is indurated fractured limestone bedrock that has a very thin lime coating.

Most of this association is in range and wildlife habitat. The vegetation is a moderate cover of grasses, forbs, and thorny brush. The soils are not well suited to cultivation. In some areas, caliche and limestone are mined for road material.

Wildlife is abundant, and deer thrive on the shrubs. This association has fewer turkeys than the other associations because roosting places are scarce. Scattered farm ponds furnish good fishing.

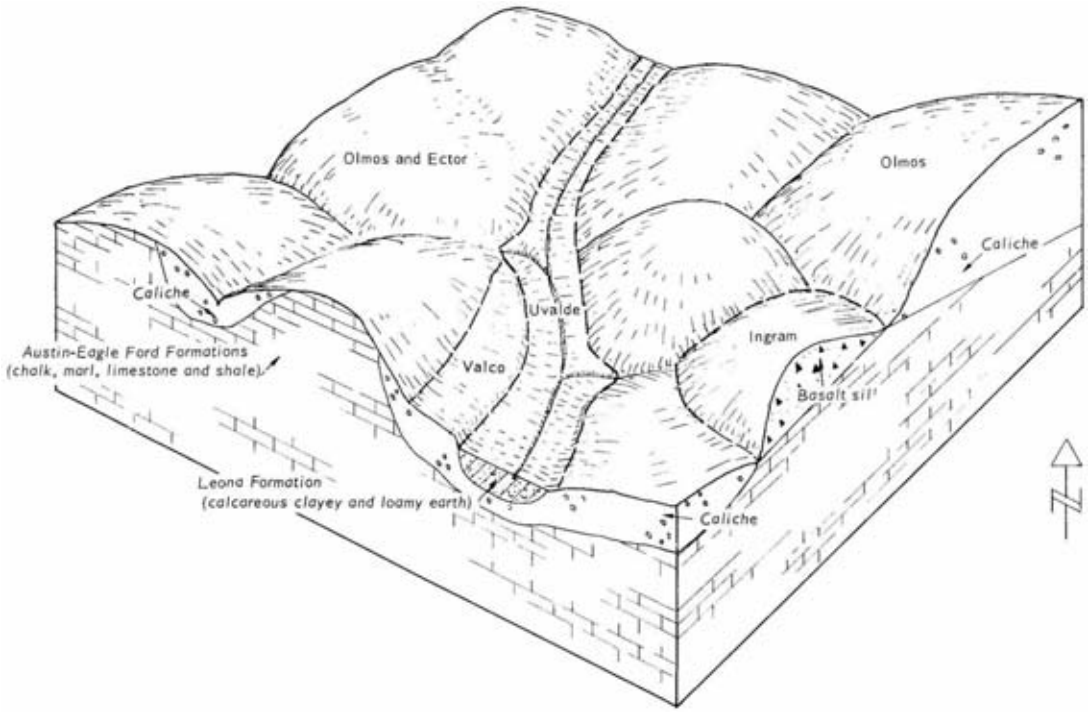

Figure 5.—Representative pattern of soils in the Olmos-Ector association.

5. Hindes-Yologo-Olmos association

Undulating, deep to very shallow gravelly loamy soils

This association is made up of undulating ridges. Slopes range from about 1 to 8 percent.

This association makes up about 5 percent of the county. Hindes soils account for about 22 percent of the association, Yologo soils 12 percent, and Olmos soils 12 percent. The other 54 percent is less extensive areas of Caid, Duval, Knippa, Montell, Randado, Rehm, Uvalde, Valco, Webb, and Zavco soils.

Hindes soils have a dark reddish-brown gravelly sandy clay loam surface laver about 8 inches thick. The next layer, about 23 inches thick, is very gravelly clay. The underlying material to a depth of 60 inches is pink caliche of clay loam texture.

Yologo soils have a reddish-brown gravelly loam surface layer about 5 inches thick. The next layer, about 7 inches thick, is reddish-brown very gravelly clay loam. The underlying material to a depth of 60 inches is caliche that is in indurated plates in the upper 2 inches.

Olmos soils have a dark grayish-brown gravelly loam surface layer about 13 inches thick. The underlying material to a depth of 26 inches is caliche that is indurated in the upper 1 inch.

All this association is in range and wildlife habitat and is grazed by cattle, sheep, and goats. The vegetation is a cover of grasses, forbs, and thorny brush. Wildlife is abundant, and deer do well on the shrubs and forbs. The major soils of this association are not suitable for cultivation. In some areas, caliche is mined for road material.

6. Webb-Zavco-Duval association

Nearly level to gently sloping, deep loamy soils

This association makes up about 2 percent of the county. It is about 20 percent Webb soils, 15 percent Zavco soils, and 12 percent Duval soils. The other 53 percent is less extensive areas of Caid, Hindes, Olmos, Randado, and Valco soils. These soils occur in mixed, irregular patterns. Slopes are 0 to 3 percent and are convex and concave.

Webb soils have a brown fine sandy loam surface layer about 9 inches thick. The next layer, about 37 inches thick, is reddish-brown sandy clay loam in the upper 5 inches. The lower 32 inches is sandy clay that is reddish brown in the upper part and yellowish red in the lower part. The underlying material is reddish-yellow sandy clay loam.

Zavco soils have a brown sandy clay loam surface layer about 9 inches thick. The next layer is reddish-brown sandy clay loam about 8 inches thick. The next layer, extending to a depth of 42 inches, is sandy clay that is reddish brown in the upper part and yellowish red in the lower part. The underlying material to a depth of 54 inches is reddish-yellow sandy clay loam that overlies weakly consolidated sandstone.

Duval soils have a reddish-brown fine sandy loam surface layer about 12 inches thick. The next layer, extending to a depth of 46 inches, is red sandy clay loam. The underlying material is reddish-yellow and yellowish-brown soft sandstone.

This association is in range and wildlife habitat. Much of it is covered with thorny brush. Wildlife is not abundant, but some kinds frequent the association.

Descriptions of the Soils

This section describes the soil series and mapping units of Uvalde County. The approximate acreage and proportionate extent of each mapping unit are given in table 1.

A general description of each soil series is given, and this is followed by brief descriptions of the mapping units in that series. For full information on any one mapping unit, it is necessary to read the description of the soil series as well as the description of the mapping unit.

An important part of each series description is the representative profile. This profile is first described briefly in terms familiar to the layman, and then in detail in terms suitable for scientists, engineers, and others who need to make thorough and precise studies of soils. In both descriptions, colors are for a dry soil unless otherwise indicated.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. In the description of each mapping unit are suggestions on management. Listed at the end of the description of each mapping unit are the dryland and irrigated capability units, the pasture and hayland group, and the range site in which the mapping unit has been placed. Only soils suited to irrigation have been placed in an irrigated capability unit, and only soils suited to pasture and hay have been placed in a pasture and hayland group.

Many terms used in the soil descriptions and other sections of the survey are defined in the Glossary.

Atco Series

The Atco series consists of deep, nearly level and gently sloping, calcareous soils on stream terraces. In a representative profile, the surface layer is light brownish-gray loam about 9 inches thick. The next layer is pale-brown friable loam in the upper 6 inches and very pale brown friable sandy clay loam in the lower 33 inches. The

underlying material is very pale brown loam reaching to a depth of more than 72 inches (fig. 6).

These soils are well drained and moderately permeable. Runoff is slow to medium, and the available water capacity is high. Atco soils are used mainly for range. A small acreage is dryfarmed, and an equally small acreage is irrigated. Small grain, grain sorghum, and introduced grasses are the main dryland crops. Those same crops and cotton, corn, onions, carrots, cabbage, and other truck crops are irrigated. The high lime content of the soil causes chlorosis in some plants. Inadequate moisture is often a limiting factor where these soils are dryfarmed.

Representative profile of Atco loam, 0 to 1 percent slopes, 2.6 miles north of Knippa, Tex., by Farm Road 1049, then 0.7 mile west on county road and 150 feet north, in range.

A1—0 to 9 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; slightly hard, very friable; many fine roots, old root channels, and fine pores; few worm casts; few snail shell fragments; upper one inch is slightly compacted; surface crust 1/16 to 1/4 inch thick that is slightly lighter in color and slightly more sandy in texture; calcareous; moderately alkaline; clear, smooth boundary.

B21—9 to 15 inches, pale-brown (10YR 6/3) loam, dark brawn (10YR 4/3) moist; weak, fine, subangular blocky structure; slightly hard, friable; many fine roots, old root channels, and fine pores; few worm casts; common fine threads of segregated calcium carbonate; few snail shell fragments; calcareous; moderately alkaline; gradual, smooth boundary.

B22—15 to 29 inches, very pale brown (10YR 7/3) sandy clay loam, brown (10YR 5/3) moist; weak, fine, subangular blocky structure; slightly hard, friable; many

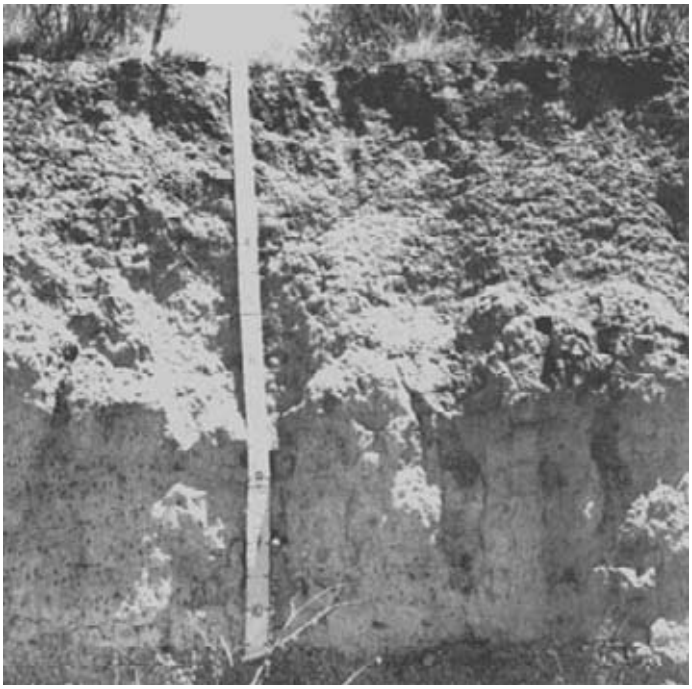

Figure 6.—Profile of an Atco loam. Dark spots below a depth of about 7 feet are small holes made by insects.

fine roots, old root channels, and fine pores; few worm casts; common fine threads of segregated calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B23—29 to 48 inches, very pale brown (10YR 7/4) sandy clay loam, yellowish brown (10YR 5/4) moist; weak, fine and medium, subangular blocky structure; slightly hard, friable; few roots; few worm casts; few snail shell fragments; few threads of segregated calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C—48 to 72 inches, very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable, and somewhat compacted; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. Coarse fragments in the solum consist of rounded limestone and siliceous pebbles and range from less than 1 percent to about 5 percent, by volume. Electrical conductivity ranges from about 0.4 to 1.2 millimhos between depths of 10 and 40 inches.

The A horizon ranges from 6 to 16 inches in thickness and from light brownish gray or grayish brown to very pale brown and brown in color. The calcium carbonate content of this horizon ranges from 30 to 50 percent.

The B2 horizon ranges from 31 to 54 inches in thickness, from brown or pale brown to very pale brown in color, and from loam to clay loam or sandy clay loam in texture. The B and C horizons are from 40 to 70 percent calcium carbonate.

The C horizon is mainly very pale brown or pale brown. Visible calcium carbonate ranges from a few segregated films and threads to about 5 percent soft masses, or weakly to strongly cemented concretions. Coarse fragments make up from less than 1 percent to as much as 50 percent of the C horizon.

Atco loam, 0 to 1 percent slopes (AtA).—This nearly level soil is on broad stream terraces. Slopes are mainly less than 0.5 percent. Most areas are longer than they are wide, but in places they are subrounded. They are typically about 200 acres in size, but range from about 10 to more than 500 acres. This soil has the profile described as representative of the Atco series.

Included with this soil in mapping are a few areas where layers of gravelly loam are below a depth of 12 inches and a few areas where slopes are 1 to 3 percent.

This Atco loam is used mainly for range; but small areas are dryfarmed, and a few are irrigated. Runoff is slow, and the hazard of erosion is slight.

A cropping system that protects the soil during plant growth and furnishes sufficient residue to protect and improve the soil between crops is needed in both dryland and irrigated areas. In addition, a well-designed irrigation system and proper management of water are needed on irrigated land.

The main adapted plants used for pasture and hay are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, and buffelgrass. Good pastures need proper fertilization, weed control, and controlled grazing. In hayfields, the cutting of the hay at recommended height and growth stage are equally important. Capability unit IIIs-1, dryland, and IIs-1, irrigated; pasture and hayland group 7C; High Lime range site.

Atco loam, 1 to 3 percent slopes (AtB).—This gently sloping soil is on narrow breaks on stream terraces and on small, subrounded knolls within areas of nearly level Atco loam. Slopes are mainly 1 to 2 percent. Most areas are long and narrow and range from about 8 to 75 acres in size.

The surface layer is light brownish-gray loam about 8 inches thick. The next layer is very pale brown friable clay loam about 37 inches thick. Below this is very pale brown clay loam that extends to a depth of 60 inches.

Included with this soil in mapping are a few areas that have layers of gravelly loam below a depth of 12 inches and a few areas where slopes are less than 1 percent. In places, Sabenyo soils are at higher elevations. Also included are eroded areas as much as 1 acre in size and a few rills or gullies as much as 2 feet deep.

This Atco loam is used mainly for range, but a few areas are dryfarmed. Runoff is medium, and the hazard of erosion is moderate. Where cultivated, a cropping system is needed that protects the soil during plant growth and furnishes sufficient residue to protect and improve the soil between crops. Terracing and contour farming help control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed on irrigated land.

The main adapted plants used for pasture and hay are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, kleingrass, blue panicum, and buffelgrass. Proper fertilization and weed control and controlled grazing are good management practices for pastures. In hayfields, fertilization, weed control, and cutting the hay at the recommended height and growth stage are important. Capability unit IIIe-1, dryland, and IIe-1, irrigated; pasture and hayland group 7C; High Lime range site.

Badland

Badland (Bd) is gently sloping. It is below areas of Ector soils, or Olmos and Ector soils, and above areas of Uvalde silty clay loam and Knippa clay. The exposed clayey materials are light colored, are strongly calcareous, and contain many fossils. Soil formation is almost negligible because soil material is removed, almost as fast as it forms, by eroding runoff waters from the steeper, higher lying soils. Slopes range from about 1 to 5 percent, but are commonly 1 to 3 percent.

Areas of Badland are mostly 15 to 35 acres in size, but range from 8 to 50 acres. They occur as bands 200 to 1,000 feet wide around the more sloping hills. Small rills or gullies a few inches to 3 feet deep and a few inches to as much as 10 feet wide occur in some areas.

Included with Badland in mapping are areas of Knippa, Sabenyo, Uvalde, and Zapata soils. Also included in the southern part of the county is about 25 acres of exposed sandstone material.

Badland is unsuitable for cultivation and has a poor potential for range. All the acreage is in range. The vegetation is a sparse cover of scattered shrubs, short grasses, and forbs.

A representative area of Badland is 0.9 mile north on U.S. Highway 83 from its junction with Texas Highway 55, at the north edge of Uvalde. Capability unit VIIe-1, dryland; pasture and hayland group and range site not assigned.

Bosque Series, Coarse Subsoil Variant

This coarse subsoil variant of the Bosque series consists of deep, nearly level to gently sloping, calcareous soils on flood plains.

In a representative profile, the surface layer is about 26 inches thick. The upper part is grayish-brown loam, and the lower part is grayish-brown fine sandy loam that is about 10 percent, by volume, water-rounded limestone pebbles. The underlying material is brown very friable fine sandy loam that has seams and pockets of darker silt loam and silty clay loam. It is about 5 percent limestone pebbles (fig. 7).

These soils are well drained, and their permeability is moderate. Runoff is slow, and the available water capacity is high. These soils are flooded once every 5 to 10 years, but flooding lasts less than 2 days.

These Basque soils are used mainly as range. A small acreage is cultivated to small grain and grain sorghum. Inadequate moisture is often a limiting factor where this soil is dryfarmed.

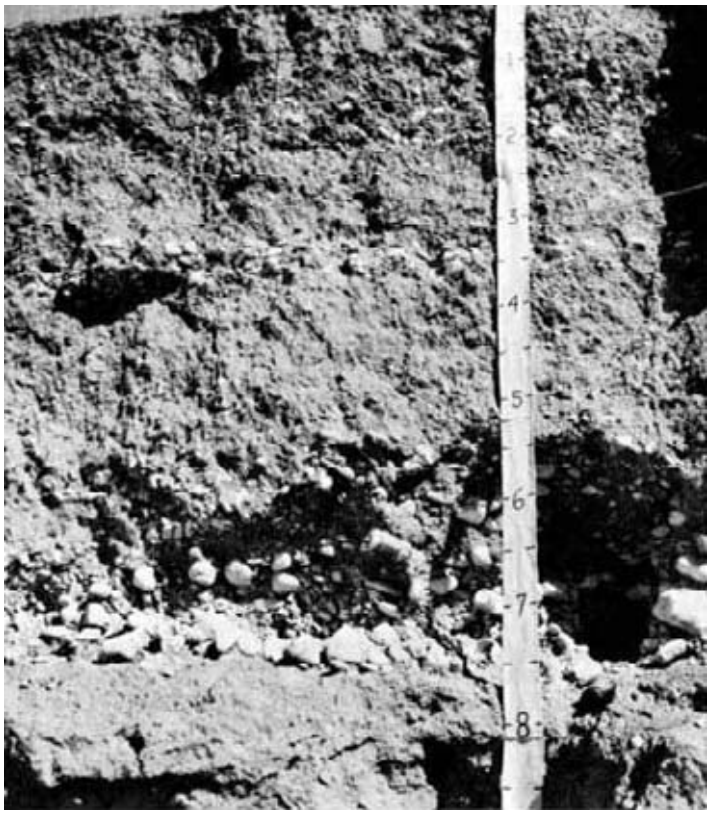

Figure 7.—Profile of Bosque loam, coarse subsoil variant.

Representative profile of Basque loam, coarse subsoil variant, 18.4 miles northwest by Texas Highway 55 from its junction with U.S. Highway 83 at north edge of Uvalde, Tex., then 4.6 miles west on Farm Road 334, then 0.4 mile south on ranch road, and 200 feet southwest of windmill, in range.

A11—0 to 12 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular structure; slightly hard, very friable; many fine roots; many snail shell fragments; few worm casts; few water-rounded limestone pebbles as much as 2 inches in diameter; thin crusty surface slightly lighter in color; surface inch slightly compacted; calcareous; moderately alkaline; clear, smooth boundary.

A12—12 to 26 inches, grayish-brown (10YR 5/2) fine sandy loam, dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure; slightly hard, very friable; few fine roots; few snail shell fragments; common films and threads of segregated calcium carbonate; estimated 10 percent, by volume, water-rounded limestone pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

C—26 to 60 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine, subangular blocky structure; slightly hard, very friable; few discontinuous seams and small pockets of darker-colored silt loam and silty clay loam; less than 5 percent, by volume, limestone pebbles; few films and threads of segregated calcium carbonate; calcareous; moderately alkaline.

Depth of the soil to gravelly substrata ranges from about 3 to 20 feet. More than 40 percent of the soil that is less than 2 millimeters in diameter is carbonates. In

some places the soil is moist most of the time below a depth of about 6 feet. The A horizon is grayish brown or brown. The A12 horizon ranges from fine sandy loam to loam in texture and stratification ranges from weakly to moderately evident. The C horizon is grayish brown, brown, or very pale brown.

Bosque loam, coarse subsoil variant (Bo).—This nearly level to gently sloping soil is on flood plains, in long narrow bands that are parallel to stream channels and range from 20 to 200 acres in size. Slopes are commonly 0 to 2 percent. Slight mounds are in some areas.

Included with this soil in mapping are a few areas of Conalb, Dev, Frio, and Orif soils.

This Bosque loam is subject to a slight hazard of erosion. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect and improve the soil between crops. If the soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are improved bermudagrass, Kleberg bluestem, blue panicum, Medio bluestem, Gordo bluestem, and buffelgrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIc-1, dryland, and I-1, irrigated; pasture and hayland group 2A; Loamy Bottomland range site.

Brackett Series

The Brackett series consists of shallow, undulating to hilly, calcareous soils on uplands. These soils formed in limestone, marl, and shale.

In a representative profile, the surface layer is light-gray calcareous loam about 6 inches thick. The next layer, about 8 inches thick, is very pale brown, friable loam. The underlying material to a depth of 72 inches is very pale brown, weakly cemented limestone that contains lenses of yellow and yellowish-brown marl (fig. 8).

Brackett soils are well drained. Permeability is moderately slow. Runoff is rapid, and the available water capacity is low.

Brackett soils are used as range and wildlife habitat. They are best suited to these uses. In some areas, roadbed material has been mined from open pits.

Representative profile of Brackett loam, in an area of Brackett and Real soils, undulating, 0.5 mile south on Farm Road 187 from its junction with Farm Road 1050 at Utopia, Tex., then 6.8 miles southeast on dirt road to pit on east side of road, then 200 feet east of pit, in range.

A1—0 to 6 inches, light-gray (10YR 7/2) loam, brown (10YR 4/3) moist; weak, fine and medium, subangular blocky structure parting to moderate, fine and very fine, granular; hard, friable; many fine roots and old root channels; many worm casts; few, small, hard calcium carbonate concretions and limestone fragments up to 1 inch in diameter, crusty surface 1/4 to 1/2 inch thick that is slightly lighter in color; about 10 percent limestone fragments on the surface that are mainly inch to 2 inches in diameter; calcareous; moderately alkaline; clear, wavy boundary.

B2—6 to 14 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist, weak, fine and medium, subangular blocky structure parting to moderate, fine and very fine, granular; hard, friable; few fine roots; open and porous; many worm casts; few threads and films of segregated calcium carbonate; few limestone fragments 1 to 10 millimeters in size; calcareous; moderately alkaline; abrupt, wavy boundary.

Figure 8.—Profile of a Brackett soil.

C—14 to 72 inches, very pale brown (10YR 8/3) limestone, yellow (10YR 8/6) moist; weakly cemented; many lenses of yellow and yellowish-brown marl; many thin streaks or coatings of whitish calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 10 to 20 inches in thickness. Content of coarse fragments ranges from an insignificant number of limestone pebbles to 35 percent, by volume, limestone fragments.

The A horizon ranges from 3 to 8 inches in thickness, from loam or gravelly loam to clay loam or gravelly clay loam in texture, and from light gray to pale brown or very pale brown in color. The calcium carbonate content ranges from 40 to 50 percent.

The B horizon ranges from 4 to 15 inches in thickness, from loam or gravelly loam to clay loam or gravelly clay loam in texture, and from pale brown or very pale brown to light yellowish brown or pale yellow in color. The calcium carbonate content ranges from 40 to 80 percent.

The C horizon is very pale brown or pale yellow to white and in places has yellow to brown streaks or splotches. This horizon is marl or shale interbedded with limestone. The limestone layer ranges from thin lenses to several feet in thickness. In many places the marl or shale is not evident, and the solum rests on soft limestone.

Brackett and Real soils, undulating (BRB).—This mapping unit is on foot slopes below steeper soils and on small isolated hills within areas of deeper soils in surrounding valleys. In most areas it is about 54 percent Brackett soil, 26 percent Real soil, and 20 percent Kavett, Pratley, Speck, and Valente soils and Rock land. The percentage of the Brackett soil ranges from 40 to 80 percent, and that of the

Real soil from 0 to 40 percent. The composition of this unit is more variable than that of most other units in the county but has been controlled well enough to interpret for the expected use of the soils.

The topography is mostly benchlike. The soil varies between the outer edge of the bench and the inner edge. It is deeper along the inner parts. The surface layer ranges from loam or gravelly loam to clay loam or gravelly clay loam.

Areas range from 75 to 300 acres in size, but are mostly about 150 acres. In most places they are broad, irregularly shaped bands along the lower slopes of the steeper Brackett and Real soils and areas of the Rock land-Real association. On the small isolated hills, areas are oval to irregular in shape. Slopes range from 2 to 8 percent and average about 7 percent.

The Brackett soil in this mapping unit has the profile described as representative of the Brackett series.

The Real soil has a surface layer of dark grayish-brown gravelly clay loam about 6 inches thick. The next layer is about 8 inches thick and is dark grayish-brown, friable very gravelly clay loam that is about 70 percent limestone fragments, mainly pebbles and a few cobblestones and stones. The underlying material is white, weakly cemented limestone and marl.

This mapping unit is well drained. Permeability is moderately slow to moderate. Runoff is rapid, and the available water capacity is low. The hazard of erosion is severe. Capability unit VIs-1, dryland; Adobe range site.

Brackett and Real soils, hilly (BRE).—This mapping unit is on foot slopes in areas of hilly topography, below the steeper Rock land-Real association and on isolated hills that are surrounded by less sloping Brackett and Real soils and by the deeper soils in the valleys. A mapped area is ordinarily about 60 percent Brackett soil, 21 percent Real soil, and 19 percent Eckrant, Kavett, Pratley, Speck, and Valente soils. The soils occur in an irregular pattern. The percentage of the Brackett soil ranges from 40 to 70, and that of the Real soil from 10 to 35. The composition of this unit is more variable than that of most other units in the county but has been controlled well enough to interpret for the expected use of the soils.

These soils are on a benchlike landscape (fig. 9). They are deeper at the inner edge of the bench than at the outer edge. The surface layer ranges from loam or gravelly loam to clay loam or gravelly clay loam.

Most areas are oval to irregular in shape. Areas range from 100 to 500 acres in size, but the average size is about 250 acres. Slopes range from 8 to 30 percent, but are dominantly about 14 percent.

The Brackett soil has a surface layer of pale-brown gravelly loam that is 7 inches thick and about 15 percent fine limestone fragments. The next layer is 5 inches of very pale brown, friable gravelly loam that is about 25 percent limestone pebbles. The underlying material is pale-yellow, weakly cemented limestone and marl.

The Real soil has a surface layer of dark grayish-brown gravelly loam that is 5 inches thick and about 20 percent limestone fragments. The next layer is 7 inches of dark grayish-brown, friable very gravelly loam that is 75 percent limestone pebbles and a few cobblestones and stones. The underlying material is white, weakly cemented limestone.

The soils in this mapping unit are well drained. Permeability is moderately slow to moderate. Runoff is rapid, and the available water capacity is low. The hazard of erosion is severe. Capability unit VIIs-1, dryland; Steep Adobe range site.

Figure 9.—Brackett and Real soils, hilly, showing benchlike topography.

Caid Series

The Caid series consists of nearly level to gently sloping, deep, calcareous soils on upland plains. These soils formed in water and wind-deposited materials.

In a representative profile, the surface layer, about 12 inches thick, is dark grayish-brown sandy clay loam. The next layer extends to a depth of 76 inches. The upper 13 inches is brown friable sandy clay loam, the next 10 inches pale-brown firm clay loam, and the next 13 inches light yellowish-brown firm sandy clay loam that is about 30 percent lime accumulations as soft lumps and concretions. The lower 28 inches is reddish-yellow sandy clay loam that is about 20 percent lime accumulations in the upper part and 10 percent in the lower part.

Caid soils are well drained. Permeability is moderate. Runoff is slow to medium, and the available water capacity is high.

These soils are used mainly as range and wildlife habitat. A few small areas are cultivated to small grain and grain sorghum. These soils are well suited to irrigation.

Representative profile of Caid sandy clay loam, 0 to 1 percent slopes, 1.4 miles south of the courthouse in Uvalde, Tex., on Farm Road 117, then 10.5 miles southeast on Farm Road 140 to Kincaid Ranch Gate No. 15, then 300 feet south and 100 feet west of gate, in range.

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine and medium, subangular blocky structure; slightly hard, friable; many fine roots, few fine pores and old root channels; few calcium carbonate concretions less than 1 millimeter in diameter; few snail shell fragments; thin crust on surface; calcareous; moderately alkaline; gradual, smooth boundary.

B21t—12 to 25 inches, brown (10YR 5/3) sandy clay loam; dark brown (10YR 4/3) moist; moderate, medium, prismatic structure parting to moderate, fine

and medium, subangular blocky; hard, friable; many fine roots, fine pores, and old root channels; many thin clay films on peds; few worm casts; few calcium carbonate concretions less than 2 millimeters in diameter; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B22tca—25 to 35 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate, fine and medium, subangular blocky structure; very hard, firm; few roots, fine pores, and old root channels; many clay films on peds; few worm casts; about 5 percent, by volume, calcium carbonate concretions up to 3/4 inch in diameter; few, fine, black-brown concretions; calcareous; moderately alkaline; clear, wavy boundary.

B23tca—35 to 48 inches, light yellowish-brown (10YR 6/4) sandy clay loam; yellowish brown (10YR 5/4) moist; weak, fine and medium, subangular blocky structure; hard, firm; few fine roots; about 30 percent, by volume, soft lumps and concretions of calcium carbonate; few black masses 1 to 3 millimeters in size; calcareous; moderately alkaline; gradual, wavy boundary.

B24tca—48 to 62 inches, reddish-yellow (7.5YR 7/6) sandy clay loam, reddish yellow (7.5YR 6/6) moist; moderate, fine and medium, angular blocky structure; very hard, firm; few, thin, clay films on peds; about 20 percent, by volume, soft masses and concretions of calcium carbonate; few black masses 1 to 3 millimeters in size; calcareous; moderately alkaline; gradual, wavy boundary.

B25t—62 to 76 inches. reddish-yellow (7.5YR 7/6) sandy clay loam, reddish yellow (7.5YR 6/6) moist; moderate, fine and medium, angular blocky structure; very hard, firm; few, thin, clay films on peds; about 10 percent, by volume, soft masses and concretions of calcium carbonate; few black masses 1 to 3 millimeters in size; calcareous; moderately alkaline.

The solum ranges from 60 to 100 inches or more in thickness. The soil above the layer that is 15 to 35 percent, by volume, calcium carbonates is 25 to 40 inches thick.

The A horizon is brown, dark grayish brawn, or very dark grayish brown. The Bt horizon is brown, pale brown, or grayish brown in the upper part and reddish yellow or brownish yellow in the lower. This horizon ranges from clay loam to sandy clay loam.

The Btca horizon is very pale brown, light yellowish brown, brownish yellow, light brown, or reddish yellow. It is from 15 to 35 percent, by volume, calcium carbonate. In some places the C horizon below a depth of 60 inches contains a few yellowish sandstone fragments.

Caid sandy clay loam, 0 to 1 percent slopes (CaA).—This nearly level soil is on upland plains, in irregular to subrounded areas that range from 15 to 250 acres in size. Slopes are mainly 0.2 to 0.7 percent. This soil has the profile described as representative of the Caid series.

Included with this soil in mapping are a few areas that have slopes greater than 1 percent that are mainly adjacent to small drains. Also included are a few areas that are more clayey throughout and some areas that have a noncalcareous surface layer.

Runoff is slow, and this Caid sandy clay loam is subject to a slight hazard of erosion. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnish sufficient residue to protect the soil between crops. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, blue panicum, and buffelgrass. Among the

management needs of good pastures are proper fertilization and weed control, a proper stocking rate, and rotational grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIc-2, dryland, and I-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

Caid sandy clay loam, 1 to 3 percent slopes (CaB).—This gently sloping soil is on uplands, in subrounded or long and narrow areas that are mostly parallel and adjacent to small drains. Areas range from 10 to 100 acres in size. Slopes are mainly 1 to 2 percent.

In a representative profile of this soil, the surface layer is very dark grayish brown sandy clay loam about 12 inches thick. The next layer is grayish-brown friable sandy clay loam about 11 inches thick. Below this is 11 inches of pale-brown friable sandy clay loam that is about 5 percent lime accumulations. The underlying material is brownish-yellow clay loam that reaches to a depth of 60 inches and is about 25 percent lime accumulations as soft lumps and cemented concretions.

Included with this soil in mapping are a few areas that have slopes less than 1 percent and a few areas that are more clayey throughout.

Runoff is medium, and this Caid sandy clay loam is subject to a moderate hazard of erosion. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. If the soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, blue panicum, and buffelgrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIe-2, dryland, and IIe-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

Castroville Series

The Castroville series consists of nearly level to gently sloping, deep, calcareous soils on stream terraces. These soils formed in calcareous sediments washed from limestone areas.

In a representative profile, the surface layer is brown clay loam about 12 inches thick. The next layer, about 38 inches thick, is pale brown, The upper 10 inches is clay loam that contains films and threads of lime. The lower part is firm clay that has 3 to 5 percent lime accumulations in the lower 1.4 inches. The underlying material is very pale brown clay containing a few films, threads, and soft masses of lime.

Castroville soils are well drained. Permeability is moderate, and runoff is slow to medium. The available water capacity is high.

These soils are used mainly as range and wildlife habitat. They are well suited to cultivation, especially if irrigated. Small grain and grain sorghum are the main dryland crops. These same crops and cotton, corn, and truck crops, including both summer and winter vegetables, are the main irrigated crops (fig. 10).

Representative profile of Castroville clay loam, 0 to 1 percent slopes, 1 mile east of the courthouse in Uvalde, Tex., on U.S. Highway 90, then 7.4 miles east on Farm Road 1023, then 100 feet north of road, in a cultivated field.

Ap—0 to 5 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure; one-fourth inch crust on surface that is pale brown (10YR 6/3); hard, friable; few fine roots; few snail shell fragments; calcareous; moderately alkaline; abrupt, smooth boundary.

Figure 10.—-Irrigated corn in a field of Castroville clay loam, 0 to 1 percent slopes.

A1—5 to 12 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate, fine, subangular blocky structure; hard, friable; few fine roots; few snail shell fragments; few worm casts; calcareous; moderately alkaline; gradual, wavy boundary.

B21—12 to 22 inches, pale-brown (10YR 6/3) clay loam, dark brown (10 YR4/3) moist; moderately fine subangular blocky structure; hard, friable; few fine roots; few worm casts; few snail shell fragments; common threads and films of segregated calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B22—22 to 36 inches, pale-brown (10YR 6/3) clay, brown (10YR 5/3) moist; moderate, fine and medium, subangular blocky structure; very hard, firm; few threads, films, and small masses of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

B23ca—36 to 50 inches, pale-brown (10YR 6/3) clay, brown (10YR 5/3) moist; weak, fine, subangular blocky structure; very hard, firm; about 3 to 5 percent, by volume, soft masses of calcium carbonate up to one-half inch in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—50 to 64 inches, very pale brown (10YR 7/3) clay, pale brown (10YR 6/3) moist; massive; very hard, firm; few threads, films, and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 45 to 70 inches in thickness. Gravel makes up from less than 15 percent of the soil in the upper 40 inches to as much as 25 to 30 percent below a depth of 40 inches.

The A horizon ranges from 11 to 16 inches in thickness and is grayish brown or brown. The B2 horizon ranges from brown or pale brown to yellowish brown or very pale brown. It is clay loam, clay, or silty clay. The C horizon ranges from less than 2

to about 10 percent, by volume, visible calcium carbonate in the form of threads, films, soft lumps, and concretions.

Castroville clay loam, 0 to 1 percent slopes (CcA).—This level or nearly level soil is on stream terraces, in long and narrow areas that are parallel and adjacent to streams. Areas range from 25 to 500 acres in size but are dominantly about 200 acres. Slopes are mainly less than 0.5 percent.

This soil has the profile described as representative of the Castroville series.

Included with this soil in mapping are a few areas that are less clayey throughout. Also included are a few areas of Atco, Frio, and Uvalde soils.

Runoff is slow on this Castroville clay loam, and it is subject to a slight hazard of erosion. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, King Ranch bluestem, blue panicum, and buffelgrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage also are important. Capability unit IIc-1, dryland, and 1-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

Castroville clay loam, 1 to 3 percent slopes (CcB).—This gently sloping soil is on stream terraces, in long and narrow areas. Slopes are mainly 1 to 2 percent. Areas range from 10 to 100 acres in size but are commonly about 25 acres.

In a representative profile of this soil, the surface layer is grayish-brown clay loam about 12 inches thick. The next layer is firm clay about 36 inches thick. The upper part is brown and the lower part is pale-brown firm clay that is about 5 percent lime as films, threads, and soft lumps. The underlying material is yellowish-brown clay that reaches to a depth of 60 inches and is 2 to 3 percent lime as films, threads, or soft lumps.

Included with this soil in mapping are areas that have slopes of less than 1 percent and areas of Atco and Uvalde soils.

Runoff is medium, and this Castroville clay loam is subject to a slight to moderate hazard of erosion. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnish sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, blue panicum, and buffelgrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage all are important. Capability unit IIe-1, dryland, and IIe-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

Comitas Series, Sandy Subsoil Variant

This sandy subsoil variant of the Comitas series consists of nearly level to gently sloping, deep, noncalcareous soils on uplands.

In a representative profile, the surface layer is brown, medium acid fine sand in the upper 9 inches and reddish-brown, strongly acid fine sand in the lower 15 inches. The next layer extends to a depth of 84 inches. It is reddish-brown, very friable, strongly acid loamy fine sand in the upper 10 inches. The next 20 inches is yellowish-red, very friable, strongly acid loamy fine sand, and the lower 30 inches is red, very friable, strongly acid fine sandy loam.

These Comitas soils are used as range and wildlife habitat. They are well drained, and permeability is moderately rapid, Runoff is slow, and the available water capacity is low.

Representative profile of Comitas fine sand, sandy subsoil variant, 1.4 miles south of the courthouse in Uvalde, Tex., on Farm Road 117, then 13.8 miles southeast on Farm Road 140 to Kincaid Ranch Gate No. 10, then 0.6 mile north on a ranch road, then 0.5 mile east on a ranch road and 50 feet south, in range.

A11—0 to 9 inches, brown (7.5YR 4/2) fine sand, dark brown (7.5YR 3/2) moist; single grained; loose; many fine roots; medium acid; clear, smooth boundary.

A12—9 to 24 inches, reddish-brown (5YR 4/3) fine sand, dark reddish brown (5YR 3/3) moist; single grained; loose; few fine roots; strongly acid; gradual, smooth boundary.

B1t—24 to 34 inches, reddish-brown (5YR 4/4) loamy fine sand, dark reddish brown (5YR 3/3) moist; weak, fine, subangular blocky structure; soft, very friable; few fine roots; sand grains coated; strongly acid; diffuse, wavy boundary.

B21t—34 to 54 inches, yellowish-red (5YR 4/6) loamy fine sand, yellowish red (5YR 3/6) moist; weak, fine and medium, subangular blocky structure; soft, very friable; very few roots; sand grains coated; strongly acid; diffuse, wavy boundary.

B22t—54 to 84 inches, red (2.5YR 4/6) fine sandy loam, dark red (2.5YR 3/6) moist; weak, fine and medium, subangular blocky structure; slightly hard, very friable; sand grains coated; strongly acid.

The solum ranges from 55 to 90 inches in thickness and from slightly acid to strongly acid in reaction. The A horizon ranges from 14 to 24 inches in thickness and is brown or reddish brown. The Bt horizon is reddish brown, yellowish red, or red and ranges from loamy fine sand to sandy clay loam.

Comitas fine sand, sandy subsoil variant (Cm).—This nearly level to gently sloping sandy soil is on uplands, in slightly irregular to subrounded areas that are about 200 acres in size. Slopes range from about 0.5 to 3.5 percent, but 1.5 to 2.0 percent slopes are most common.

Included with this soil in mapping are a few areas of loamy fine sand underlain by sandstone that is within 50 inches of the surface and areas where soils have lower layers that are more clayey. Some soils that are less than 20 inches of fine sand over more clayey layers are also included in mapping.

This droughty soil has a slight hazard of erosion if it is in range. This soil is well suited to small grain, truck crops, and peanuts, especially where irrigated. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Some cropping systems need striperopping to prevent soil blowing. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, buffelgrass, and weeping lovegrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage also are important. Capability unit IIIe-3, dryland, and IIIs-1, irrigated; pasture and hayland group 9A; Sandy Loam range site.

Conalb Series

The Conalb series consists of nearly level to gently sloping, deep, calcareous soils on flood plains. These soils are flooded once every 5 to 10 years, but flooding lasts only a few days.

In a representative profile, the surface layer is light brownish-gray loam about 6 inches thick. The next layer is light brownish-gray loam about 12 inches thick. The upper 20 inches of the underlying material is pale-brown loam that has a few thin layers of darker loam and silt loam. The lower 26 inches is very pale brown very fine sandy loam that has thin layers of darker loam, silt loam, and silty clay loam (fig. 11). In some areas the soil is gravely below a depth of 3 1/2 feet.

Conalb soils are well drained. Permeability is moderate, and runoff is slow. The available water capacity is high.

These soils are used mainly as range and wildlife habitat. A small acreage is cultivated to small grain and grain sorghum. The high lime content of the soil causes chlorosis of some plants. Inadequate moisture is a limiting factor under dryland farming.

Representative profile of Conalb loam, 1 mile east of the courthouse in Uvalde, Tex., on U.S. Highway 90, then 6.5 miles east of Farm Road 1023, then 300 feet north and 100 feet east of the Frio River, in a cultivated field.

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; one-fourth inch crust on surface that has fine platy structure; hard, friable; common fine roots; common worm casts, few termite or worm tunnels; calcareous; moderately alkaline; abrupt, smooth boundary.

B21—6 to 12 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine and medium, subangular blocky structure; hard, friable; common fine roots; common worm casts, few termite or

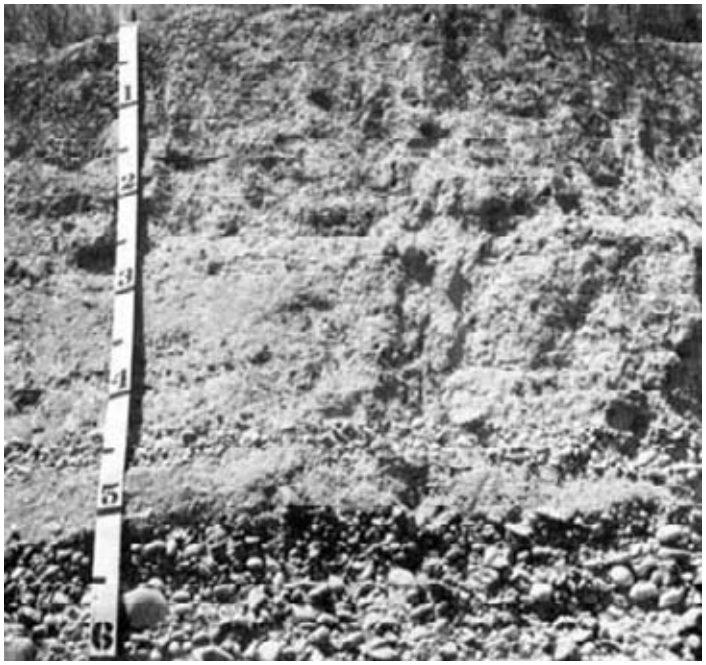

Figure 11.—Profile of Conalb loam showing gravelly substratum.

worm tunnels; few fine streaks and films of lighter-colored loam; calcareous; moderately alkaline; clear, smooth boundary.

B22—12 to 18 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine and medium, subangular blocky structure; hard, friable; few fine roots, root channels, and fine pores; few termite or worm tunnels, common worm casts; few fine streaks and films of lighter-colored loam; calcareous; moderately alkaline; abrupt, smooth boundary.

C1—18 to 28 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; hard, friable; few fine roots, old root channels, and fine pores; few termite or worm tunnels, few worm casts of slightly darker color; few strata as much as one-half inch thick of darker loam and silt loam; calcareous; moderately alkaline; diffuse, smooth boundary.

C2—38 to 64 inches, very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; hard, friable; weakly stratified in upper part and becoming more stratified with increasing depth; strata 1/2 inch to 2 inches thick of darker silty clay loam, silt loam, and loam 2 to 12 inches apart; calcareous; moderately alkaline.

The soil ranges from 42 to 72 inches or more in thickness. It is more than 40 percent carbonate and is 18 to 30 percent clay.

All horizons range from light brownish gray or grayish brown to very pale brown or pale brown. The A horizon ranges from 4 to 7 inches in thickness, and the B horizon from 10 to 22 inches. In some places, the B horizon contains a few films and threads of calcium carbonate.

The soil is stratified within 15 to 40 inches below the surface. Thin strata of sand and silt are the most common, and are the same color as the dominant material in the horizon. Gravelly strata are in some profiles below a depth of 42 inches.

Conalb loam (Co).—This nearly level to gently sloping soil is on the flood plains of streams, in narrow bands adjacent to and slightly above stream channels. Slopes are commonly 0 to 2 percent. Areas range from 10 to 250 acres in size, but are commonly 25 to 100 acres.

Included with this soil in mapping are a few acres of Dev, Frio, and Orif soils.

This Conalb loam is subject to a slight hazard of erosion. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. If the soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are improved bermudagrass, Kleberg bluestem, blue panicum, Medio bluestem, Gordo bluestem, and buffelgrass. Among the management needs of good pastures are proper fertilization and weed control, a proper stocking rate, and rotational grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIc-1, dryland, and I-1, irrigated; pasture and hayland group 2A; Loamy Bottomland range site.

Dant Series

The Dant series consists of nearly level to gently sloping, deep, calcareous soils on uplands.

In a representative profile, the surface layer is grayish-brown clay loam about 12 inches thick. The next layer, about 22 inches thick, is grayish-brown firm clay. The underlying material is very pale brown clay that reaches to a depth of 60 inches and is about 10 percent strongly cemented concretions of lime.

Dant soils are well drained. Permeability is slow, and runoff is slow to medium. The available water capacity is high. Salinity is slight to moderate within 48 inches of the surface.

These soils are used mainly as range and wildlife habitat. They also are suited to cultivation, but inadequate moisture is a limiting factor when they are dryfarmed.

Representative profile of a Dant clay loam, in an area of Dant and Uvalde soils, 0 to 1 percent slopes, 1.5 miles west of the courthouse in Uvalde, Tex., by U.S. Highway 90, then 12.4 miles southwest on Farm Road 481, then 150 feet south of road, in range.

A1—0 to 12 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, subangular blocky structure; one-fourth inch crust on surface that is slightly lighter in color; hard, firm; many fine roots, old root channels, and a few fine pores; scattered snail fragments on surface and few snail shell fragments within horizon; few threads of segregated calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B2—12 to 34 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to moderate, medium and coarse, subangular blocky structure that in turn parts to moderate, fine and very fine, blocky structure; very hard, firm; many fine roots and old root channels; few worm casts and termite tunnels; few hard limestone and sandstone pebbles up to one-half inch in diameter; few films and threads and few soft masses up to 2 millimeters in size of calcium carbonate; common streaks and splotches of organic stains on ped faces; calcareous; moderately alkaline; clear, smooth boundary.

Cca—34 to 60 inches, very pale brown (10YR 7/4) clay, yellowish brown (10YR 5/4) moist; contains a few masses that are light olive brown; about 10 percent, by volume, strongly cemented concretions of calcium carbonate and a few calcium carbonate coated pebbles; calcareous; moderately alkaline.

The solum ranges from 25 to 48 inches in thickness. When these soils are dry, cracks from 14 to 2 inches wide extend to depths of 24 to 40 inches. The coefficient of linear extensibility (COLE) ranges from 0.09 to 0.12. Salinity ranges from slightly affected to moderately affected. Limestone, chert, or sandstone pebbles are scattered on the surface, and a few are in the soil in some profiles.

The A horizon ranges from 10 to 18 inches in thickness and is grayish brown or dark grayish brown. The B horizon ranges from 17 to 30 inches in thickness. It is grayish brown or brown and ranges from clay loam to clay.

The C horizon is very pale brown or light yellowish brown. This horizon ranges from a few to 10 percent calcium carbonate masses and concretions. It is as much as 2 percent gypsum crystals, and it contains a few sandstone fragments.

Dant and Uvalde soils, 0 to 1 percent slopes (DaA).—This mapping unit consists of deep, level or nearly level soils on uplands. About 70 percent of this unit is Dant clay loam, and 20 percent is Uvalde silty clay loam. The remaining 10 percent is small areas of other soils. These soil patterns are not uniform, and the Uvalde soil is not in all mapped areas. Most areas are subrounded in shape and range from about 25 to 100 acres in size. Slopes are mainly from 0.2 to 0.75 percent.

The Dant soil in this mapping unit has the profile described as representative of the Dant series.

The Uvalde soil has a surface layer of dark grayish-brown silty clay loam about 16 inches thick. The next layer is brown firm silty clay loam about 18 inches thick. Below this is about 12 inches of pale-brown firm clay that is about 15 percent soft masses and cemented concretions of lime. The underlying material is very pale brown clay that reaches to a depth of 64 inches and is about 10 to 15 percent soft masses and cemented concretions of lime.

Included in this mapping unit are areas of Knippa, Montell, and Tobosa soils as well as a soil similar to the Dant soil except that the surface layer is lighter in color.

Both Dant and Uvalde soils are well drained. Permeability is slow to moderate. Runoff is slow, and the available water capacity is high. This mapping unit is subject to a slight hazard of erosion.

This mapping unit is used as range and wildlife habitat. It also is suited to cultivation, especially where irrigated. Small grain, grain sorghum, and introduced grasses are suitable crops for dryland farming. These same crops and many kinds of truck crops are suitable if the soils are irrigated. Inadequate moisture is a limiting factor where this unit is dryfarmed.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. A well-designed irrigation system and proper water management are needed if the soils are irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, blue panicum, Kleberg bluestem, and buffelgrass. Among the management needs of good pasture are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit for Dant part IIIs-2, dryland, and IIs-2, irrigated, and for Uvalde part IIIc-2, dry-land, and I-2, irrigated; pasture and hayland group for Dant part 7A, for Uvalde part 7C; both soils in Clay Loam range site.

Dant and Uvalde soils, 1 to 3 percent slopes (DaB).—This mapping unit consists of deep, gently sloping soils on uplands. About 75 percent of this unit is Dant clay loam, and 25 percent is Uvalde silty clay loam. Areas of this unit range from about 20 to 75 acres in size and are mainly subrounded in shape. These soil patterns are not uniform, and the Uvalde soils are not in all mapped areas. Slopes are mainly 1 to 2 percent.

In a representative profile, the Dant soil has a surface layer, about 10 inches thick, that is dark grayish-brown clay loam. The next layer is grayish-brown firm to very firm clay about 20 inches thick. The underlying material is very pale brown clay that is about 10 percent lime concretions. The number of concretions decreases with depth.

In a representative profile, the Uvalde soil has a surface layer about 12 inches thick that is grayish-brown silty clay loam. The next layer, about 20 inches thick, is pale-brown firm clay. The underlying material is very pale brown clay that reaches to a depth of 60 inches and is about 25 percent masses and concretions of lime.

Included in mapping are areas that have slopes of less than 1 percent and areas of soil similar to the Dant soil except that the surface layer is lighter in color. Less extensive areas of Knippa, Montell, and Tobosa soils are also in this unit.

Dant and Uvalde soils are well drained. Permeability is slow in Dant soils and moderate in Uvalde soils. Runoff is medium, and the available water capacity is high. This mapping unit is subject to a moderate hazard of erosion.

This unit is used as range and wildlife habitat; however, it is suited to cultivation. Small grain, grain sorghum, and introduced grasses are suitable crops for dryland farming. These same crops and many kinds of truck crops are suitable if the soil is irrigated. Inadequate moisture is a limiting factor where this unit is dryfarmed. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect and improve the soils between crops.

A well-designed irrigation system and proper water management are needed if the soils are irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, blue panicum, Kleberg bluestem, and buffelgrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important.

Capability unit for Dant part IIIe-4, dryland, and IIe-3, irrigated; and for Uvalde part IIIe-2, dryland, and IIe-2, irrigated; pasture and hayland group for Dant part 7A, for Uvalde part 7C; both soils in Clay Loam range site.

Dev Series

The Dev series consists of nearly level, deep, calcareous soils in bottom lands. These soils are flooded about once every 1 to 5 years, but flooding lasts less than 2 days.

In a representative profile, the surface layer, about 26 inches thick, is very gravelly clay loam. It is dark grayish brown in the upper part and grayish brown in the lower part and is about 60 percent waterworn limestone pebbles in the upper part and 75 percent in the lower part. The underlying material is brown very gravelly loam that contains strata that are as much as 90 percent waterworn limestone pebbles and strata that have only a few limestone pebbles.

Dev soils are well drained. Permeability is moderately rapid, and runoff is slow. The available water capacity is low.

These soils are used as range and wildlife habitat. In a few areas gravel is mined from open pits.

Representative profile of Dev very gravelly clay loam, in an area of Dev soils, 18.4 miles northwest on Texas Highway 55 from its junction with U.S. Highway 83 at the north edge of Uvalde, Tex., then 4.6 miles west on Farm Road 334, then 1.1 miles southwest along a small ranch road to a large live oak tree below a limestone bluff, then 450 feet south, in range.

A11—0 to 16 inches, dark grayish-brown (10YR 4/2) very gravelly clay loam, very dark brown (10YR 2/2) moist; moderate, fine, subangular blocky and granular structure; hard, friable; many fine roots; few worm casts; estimated 60 percent, by volume, waterworn limestone pebbles mainly less than 2 inches in size and a few cobbles; calcareous; moderately alkaline; gradual, wavy boundary.

A12—16 to 26 inches, grayish-brown (10YR 5/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky and granular structure; hard, friable; many fine roots; few worm casts; estimated 75 percent, by volume, waterworn limestone pebbles mainly less than 2 inches in size and a few cobbles; calcareous; moderately alkaline; gradual, wavy boundary.

C—26 to 42 inches, brown (10YR 5/3) very gravelly loam, dark brown (10YR 4/3) moist; stratified with layers containing only a few limestone pebbles and layers as much as 90 percent pebbles; estimated average content, by volume, of limestone pebbles is 70 percent; limestone pebbles have patchy calcium carbonate films on surfaces; calcareous; moderately alkaline.

The soil ranges from 48 to 72 inches or more in thickness. Gravel on the surface ranges from scattered to about 50 percent coverage. Between the depths of 10 to 40 inches, the soil is from 35 to 90 percent, by volume, limestone gravel that is less than 3 inches in diameter. A few cobbles and stones are in some profiles. Carbonates smaller than 20 millimeters are estimated to make up from 40 to 70 percent, by volume, of the soil.

The A horizon ranges from brown to very dark grayish brown and, exclusive of coarse fragments, from clay loam to loam. The A horizon has a few to as much as 80 percent, by volume, limestone gravel.

The C horizon ranges from grayish brown to yellowish brown. The very gravelly C horizon has strata of loam and clay loam that are practically free of gravel. These strata are discontinuous and range from a few inches to a foot or more in thickness. This horizon also has strata of different size fragments.

Dev soils (De).—These nearly level, very gravelly soils are on flood plains, in long narrow bands that are parallel to and about 2 to 15 feet above stream channels (fig. 12). Slopes are commonly 0.2 to 1 percent, and many areas have mounds.

The surface layer ranges from very gravelly loam to very gravelly clay loam. Much of these soils is covered by water even during light flooding, and almost all are covered by heavy flooding. These soils have been changed by this flooding. In some areas, the original soil material has been completely buried by as much as three feet of fresh gravel and cobbles (fig. 13).

Included with these soils in mapping are a few areas of Bosque, coarse subsoil variant, Conalb, Frio, and Orif soils. Soil patterns are not uniform, and the amount of gravel in the soils varies greatly. Soils similar to Dev soils except that the darkened surfaces are less than 20 inches thick are also in this unit.

These Dev soils are used as range and wildlife habitat, and this is their best use. Areas that have enough soil material in the surface layer for an adequate seedbed are suited to pasture and hay, especially where supplemental irrigation is used.

The main adapted plants used for pasture and hay are buffelgrass, blue panicum, and weeping lovegrass. Proper fertilization, weed control, and controlled grazing are important management needs of good pastures. On hayland, fertilization, weed control, and cutting hay at the recommended height and growth stage are important. Capability unit VIw-1, dryland; pasture and hayland group 14A; Loamy Bottomland range site.

Figure 12.—Dev soils on flood plain of Nueces River. The hills in the Background are Limestone rock land.

Figure 13.—Deposition of gravel and cobbles that occurred during a flood on Dev soils.

Duval Series

The Duval series consists of gently sloping, deep, noncalcareous soils on uplands. These soils formed in soft sandstone or interbedded sandstone and sandy clay loam material.

In a representative profile, the surface layer is reddish-brown, slightly acid fine sandy loam about 12 inches thick. The next layer, about 34 inches thick, is red sandy clay loam that is very friable in the upper 8 inches and friable below. The lower 10 inches of this layer is about 50 percent hard sandstone fragments. The underlying material is reddish-yellow and yellowish-brown soft sandstone that reaches to a depth of 54 inches.

Duval soils are well drained. Permeability is moderate, and runoff is medium. The available water capacity is moderate.

These soils are used as range and wildlife habitat. They are suited to cultivation and are adapted to many kinds of crops.

Representative profile of Duval fine sandy loam, 1 to 3 percent slopes, 1.4 miles south of the courthouse in Uvalde, Tex., by Farm Road 117, then 11.3 miles southeast on Farm Road 140, then north along fence line 0.35 mile to windmill and 300 feet southwest of windmill.

A11—0 to 3 inches, reddish-brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; compacted and nearly massive but some weak, fine, subangular blocky structure; 1/8- to 1/4-inch crust on surface; hard, very friable; few fine roots and old root channels; slightly acid; abrupt, smooth boundary.

A12—3 to 12 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, medium, prismatic structure parting to weak, fine, subangular blocky; hard, very friable; few fine roots and old root channels, and many fine pores; few worm casts; slightly acid; gradual, smooth boundary.

B1t—12 to 20 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak, medium, prismatic structure parting to weak, fine, subangular blocky; hard, very friable; few fine roots, many fine and medium pores; few termite and worm tunnels; slightly acid; gradual, smooth boundary.

B2t—20 to 36 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak, medium, prismatic structure parting to weak and moderate, fine, subangular blocky; very hard, friable; few fine roots, many fine and

medium pores; few termite and warm tunnels; few, small, hard sandstone fragments; few patchy clay films; neutral; gradual, smooth boundary.

B3t—36 to 46 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak to moderate, fine, subangular blocky structure; very hard, friable; few fine roots, many fine pores; an estimated 50 percent, by volume, hard sandstone fragments; few thin clay films; neutral; abrupt, smooth boundary.

C—46 to 54 inches, reddish-yellow (7.5YR 6/6) and yellowish-brown (10YR 5/6) neutral soft sandstone.

The solum ranges from 40 to 60 inches in thickness. The A horizon ranges from 10 to 16 inches in thickness and is reddish brown or brown.

The B1t horizon ranges from 6 to 12 inches in thickness and is red or reddish brown. Some profiles do not have a B1t horizon. The B2t horizon ranges from 16 to 26 inches in thickness and is red, reddish brown, or yellowish red. Some profiles do not have a B3t horizon.

The C layer ranges from soft to hard sandstone. A weak Cca horizon that is as much as 10 percent, by volume, disseminated hard or soft masses of calcium carbonate is in some profiles. This Cca horizon ranges from about 1 to 6 inches in thickness.

Duval fine sandy loam, 1 to 3 percent slopes (DuB).—This gently sloping soil is on uplands. Soil areas are dominantly subrounded to irregular and about 20 to 100 acres in size. Slopes are mainly 1 to 2 percent.

Included with this soil in mapping are areas of Hindes, Randado, Webb, and Yologo soils. Other inclusions are a soil similar to Duval except that it has slopes of less than 1 percent, areas of another soil similar to Duval but with sandstone within 40 inches of the surface or with a caliche underlying material, and a few eroded spots.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, buffelgrass, and blue panicum. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIe-5, dryland, and IIe-4, irrigated; pasture and hayland group 8C; Sandy Loam range site.

Eckrant Series

The Eckrant series consists of nearly level to gently sloping and undulating, moderately alkaline soils on uplands. These very shallow to shallow soils formed in material weathered from limestone or interbedded chalks and marls.

In a representative profile, the surface layer is very dark gray gravelly clay about 12 inches thick that contains limestone fragments. Below this is coarsely fractured, indurated limestone bedrock many feet thick (fig. 14).

Eckrant soils are well drained. Permeability is moderately slow, and runoff is rapid. The available water capacity is low.

Eckrant soils are used as range and wildlife habitat, and this is the best use of these soils.

Figure 14.—Profile of Eckrant soils, undulating.

Representative profile of Eckrant gravelly clay, in an area of Eckrant soils, undulating, 7.5 miles northwest of Sabinal, Tex., on Texas Highway 127, then 5 miles north on a county road to a cattleguard, then 0.1 mile north across small creek to gate on right, then 0.5 mile east on small private ranch road and 150 feet south, in range.

A11—0 to 4 inches, very dark gray (10YR 3/1) gravelly clay, black (10YR 2/1) moist; moderate, fine, subangular blocky structure and moderate, fine, granular; very hard, firm; common fine roots and pores; estimated 15 percent, by volume, limestone fragments that are larger than 3 inches and 20 percent that are smaller than 3 inches; noncalcareous; moderately alkaline; clear, irregular boundary.

A12—4 to 12 inches, very dark gray (10YR 8/1) gravelly clay, black (10YR 2/1) moist; moderate, fine, subangular blocky structure and fine, granular; very hard, firm; common fine roots and pores; estimated 35 percent limestone fragments that are larger than 3 inches and 20 percent that are smaller than 3 inches; fragments are mainly horizontally oriented and have soil fines between; noncalcareous; moderately alkaline; abrupt, wavy boundary.

R—12 to 30 inches, coarsely fractured, indurated limestone bedrock.

The solum ranges from 4 to 20 inches in thickness and corresponds to the depth to indurated limestone. The soil fines range from calcareous to noncalcareous and

from moderately alkaline to neutral in reaction. Coarse fragments in the form of subrounded to angular limestone pebbles and cobbles. Cobbles and stones account for 15 to 60 weight, of the soil. The soil also contains some chert pebbles and cobbles. Cobbles and stones accounts for 15 to 60 percent of the whole soil. Fragments smaller than 3 inches make up 35 to 60 percent of the whole soil.

The A horizon ranges from dark brown to very dark brown, very dark gray, or black. Some of the limestone along fractures is coated with calcium carbonate. In places, the underlying limestone is interbedded with softer limy material.

Eckrant soils, undulating (ECB).—This mapping unit is on undulating uplands. Eckrant soils and other shallow soils that have some similar properties make up about 73 percent of this unit. They are not in a regular pattern throughout the mapped areas. The remaining 27 percent is made up of Ector, Kavett, Olmos, Real, and San Saba soils and rock outcrops. The composition of this unit is more variable than that of most other units in the county but has been controlled well enough to interpret for the expected use of the soils.

Soil areas are subrounded to irregular in shape and range in size from about 20 to more than 500 acres. Slopes range from 1 to 8 percent but are mainly 3 to 6 percent.

The Eckrant soils have the profile described as representative of the Eckrant series. Coarse limestone fragments on the surface vary in size but average about 15 percent stone size, 20 percent cobble size, and 15 percent gravel size. These coarse fragments help to control erosion and limit evaporation. Small amounts of soil material fill the fractures in the limestone bedrock. These Eckrant soils are subject to a moderate hazard of erosion. Capability unit VIIs-2, dryland; Low Stony Hill range site.

Eckrant-Kavett complex, 0 to 5 percent slopes (EkC).—This mapping unit is about 41 percent Eckrant soil, 27 percent Kavett soil, and 18 percent Real soil. The remaining 14 percent is made up of Dev, Pratley, San Saba, and Speck soils intermixed with a few areas of rock outcrop.

These nearly level to gently sloping soils are in shallow valleys or on foot slopes below areas of steeper limestone soils and above deeper valley soils. Eckrant soil has convex slopes and is higher than the Kavett soil, which has plane to concave slopes.

Soil areas are mainly 30 to 300 acres in size. Individual areas of either Eckrant or Kavett soil are about 2 to 15 acres; but in most places, areas of Eckrant soil are larger in size (fig. 15). Slopes of Eckrant soil are mainly 1 to 5 percent, and slopes of Kavett soil are 0 to 2 percent.

The Eckrant soil has a calcareous surface layer of very dark grayish-brown clay about 9 inches thick that is about 35 percent limestone fragments in the upper 5 inches and about 75 percent in the lower 4 inches. The underlying material is fractured, indurated limestone bedrock.

The Kavett soil has a calcareous surface layer of very dark grayish-brown clay 9 inches thick. The next layer, about 9 inches thick, is dark grayish-brown, firm, calcareous clay. Below this is about 1 inch of pale-brown strongly cemented caliche. The underlying material is undurated caliche interbedded with limestone.

The soils in the mapping unit are well drained. Permeability is moderately slow, and the available water capacity is low. Runoff is rapid on Eckrant soil and slow on Kavett soil. Kavett soils benefit from the runoff of Eckrant soils.

This mapping unit is used as range and wildlife habitat. Both soils in capability unit V IIs-2, dryland; Eckrant part in Low Stony Hill range site, Kavett part in Shallow range site of the Edwards Plateau.

Figure 15.—Area of Eckrant-Kavett complex, 0 to 5 percent slopes. Kavett soils are in the foreground, and Eckrant soils are on the left and the right behind the Kavett soils. Limestones rock land is in the background.

Ector Series

The Ector series consists of undulating to hilly soils on uplands. These very shallow to shallow calcareous soils formed in materials weathered from limestone.

In a representative profile the surface layer, about 15 inches thick, is very dark grayish-brown, friable clay loam that is about 20 percent limestone fragments in the upper 6 inches and about 90 percent in the lower 9 inches. Below this is fractured, indurated limestone bedrock that has secondary lime coatings on the upper surface and tongues of lime partially filling the fractures (fig. 16).

Ector soils are well drained. Permeability is moderate, and runoff is rapid. The available water capacity is low.

Ector soils are used as range and wildlife habitat, and this is the best use of the land.

Representative profile of Ector cobbly clay loam, in an area of Ector soils, undulating, in native range 1 mile southwest of Uvalde Rock Asphalt Mine office in southwestern Uvalde County near Blewett, then 100 feet southwest of abandoned open mine pit.

A11—0 to 6 inches, very dark grayish-brown (10YR 3/2) cobbly clay loam, very dark brown (10YR 2/2) moist; moderate, fine, subangular blocky structure and fine granular structure; hard, friable; many fine roots; an estimated 20 percent, by volume, limestone fragments 1/4 to 6 inches in diameter that are calcium carbonate coated; calcareous; moderately alkaline; abrupt, wavy boundary.

A12—6 to 15 inches, very dark grayish-brown (1OYR 3/2) very cobbly clay loam, very dark brown (10YR 2/2) moist; moderate, fine, subangular blocky structure and fine granular structure; hard, friable; many fine roots; an estimated 90 percent limestone fragments that are 1 to 3 inches thick and 6 to 12 inches wide and have thin calcium carbonate coatings 1/16 to 1/2 inch thick that are thickest and slightly pisolitic on underside; calcareous; moderately alkaline; abrupt, wavy boundary.

Figure 16.—Profile of Ector soils, undulating, showing less than 20 inches of cobbly clay loam over fractured limestone.

R—15 to 20 inches, indurated, white and very pale brown, fractured limestone bedrock; yellowish-brown streaks; calcium carbonate coatings on upper surface and seams or tongues of calcium carbonate partially filling fractures.

The solum ranges from 4 to 19 inches in thickness. Coarse fragments make up from 35 to 75 percent of the soil mass in the solum. More than 40 percent of the soil mass that is less than 20 millimeters in size is limestone fragments, concretions, and reprecipitated carbonates. The coarse fragments are mainly limestone, but some are caliche and chalk. The limestone fragments are partially coated with calcium carbonate, and many are smooth on the upper surface and slightly knobby or pisolitic on the lower surface.

The A horizon is very dark grayish brown, dark grayish brown, dark brown, or brown. Exclusive of coarse fragments, this horizon ranges from loam to clay loam.

The R layer is composed of hard fractured limestone that has varying amounts of calcium carbonate filling the fractures and coatings up to about 1 inch thick on the limestone.

Ector soils, undulating (EOB).—This mapping unit is about 74 percent Ector soils and other shallow soils that have some similar properties. They are not in a regular pattern throughout the mapped areas. The remaining 26 percent is made up of Eckrant, Kavett, Olmos, Real, and Zapata soils and rock outcrops. The composition of this unit is more variable than that of most other units in the county but has been controlled well enough to interpret for the expected use of the soils.

These soils are on undulating uplands that are subrounded to irregular in shape. Areas range from about 20 acres to more than 500 acres in size. Slopes are mainly 2 to 6 percent but range from 1 to 8 percent.

These Ector soils have the profile described as representative of the Ector series. Coarse limestone fragments on the surface vary in size but average about 8 percent stone size, 11 percent cobble size, and 11 percent gravel size (fig. 17). These coarse

Figure 17.—Surface cover of limestone Fragments in an area of Ector soils, undulating. The larger fragments in the foreground are about 6 to 15 inches in diameter: those in the background are as large as 48 inches in diameter.

fragments help to control erosion and limit evaporation. These Ector soils, undulating, are subject to a moderate hazard of erosion.

Asphalt is mined from these soils in the southwestern part of the county; however, the soils as mapped are not a prerequisite to the presence of asphalt-bearing material. Capability unit VIIs-2, dryland; Stony Ridge range site.

Ector soils and Rock outcrop, hilly (ERE).—This mapping unit is on hilly uplands. A mapped area is ordinarily 63 percent Ector soil, 29 percent Rock outcrop, and 8 percent Eckrant, Kavett, Olmos, Real, and Zapata soils. The percentage of Ector soil ranges from 50 to 75 percent, and that of Rock outcrop from 10 to 40 percent. The composition of this unit is more variable than that of most other units in the county but has been controlled well enough to interpret for the expected use of the soils.

Areas are irregular in shape and range in size from about 50 to over 500 acres. Slopes range from 8 to 20 percent but are mainly 10 to 15 percent.

The Ector soil in this mapping unit has a surface layer, about 7 inches thick, of very dark grayish-brown, calcareous, friable clay loam that is about 50 percent limestone fragments. The underlying material is fractured indurated limestone that has lime coatings on the upper surface.

Coarse limestone fragments on the surface vary in size but average about 22 percent stone size, 11 percent cobble size, and 7 percent gravel size. These coarse fragments help to control erosion and limit evaporation. This mapping unit is subject to a high hazard of erosion.

Asphalt is mined in these soils in the southwestern part of the county; however, the soils as mapped are not a prerequisite to the presence of asphalt-bearing material. Ector soils part in Capability unit VIIs-2, dryland, Rock outcrop part in VIIIs-2, dryland; Ector part in Stony Ridge range site; Rock outcrop part range site not assigned.

Frio Series

The Frio series consists of nearly level to gently sloping, deep, calcareous soils on flood plains. Some areas of these soils are flooded once every 5 to 20 years. Other areas are flooded once every 1 to 5 years, but flooding on either one lasts less than 2 days.

In a representative profile, the surface layer is grayish-brown firm silty clay loam about 42 inches thick. The underlying material is pale-brown firm clay loam that reaches to a depth of 60 inches.

Frio soils are well drained. Permeability is moderately slow, and runoff is slow to medium. The available water capacity is high.

These soils are used mainly as range and wildlife habitat. A small acreage is cultivated.

Representative profile of Frio silty clay loam, 0 to 1 percent slopes, 26.2 miles north of the courthouse in Uvalde, Tex., on U.S. Highway 83, then 350 feet east of highway right-of-way, in range.

A11—0 to 24 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium and fine, subangular blocky structure; very hard, firm; many fine roots, fine and medium pores, and old root channels; few splotches and threads of lighter-colored sandy material; many worm casts; few strongly cemented calcium carbonate concretions that are 1 millimeter in size; calcareous; moderately alkaline; gradual, smooth boundary.

A12—24 to 42 inches, grayish-brown (I0YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine and medium, subangular blocky structure; hard, firm; few fine roots, fine and medium pores, and old root channels; few worm casts; few strongly cemented calcium carbonate concretions 1 millimeter in size; calcareous; moderately alkaline; gradual, smooth boundary.

C—42 to 60 inches, pale-brown (I0YR 6/3) clay loam, brown (10YR 4/3) moist; weak, fine, subangular blocky structure; hard, firm; few fine roots; few threads of segregated calcium carbonate; few strongly cemented calcium carbonate concretions up to 3 millimeters in size in lower part; calcareous; moderately alkaline.

The solum ranges from about 30 to 48 inches in thickness. The soil material, to very gravelly substrata, ranges from about 6 to 20 feet in thickness. It contains from none to a small amount of gravel in the upper part of the A horizon to as much as 25 percent gravel in the lower part of the A horizon and in the C horizon.

The A11 horizon ranges from very dark grayish brown to grayish brown. The A12 horizon ranges from dark grayish brown and grayish brown to brown. The C horizon ranges from pale brown to light brownish gray.

The Frio soils in the southern part of the county have a slightly higher soil temperature than is allowed in the series. This difference does not affect use and management of these soils.

Frio silty clay loam, 0 to 1 percent slopes (FoA).—This nearly level soil is on flood plains in long, narrow bands parallel to stream channels. It is flooded once every 5 to 20 years, and flooding lasts less than 2 days. Slopes are commonly 0.1 to 0.5 percent. Soil areas range from 25 to 250 acres in size, and some areas are slightly moundy.

This soil has the profile described as representative of the Frio series.

Included with this soil in mapping are areas of Frio soil with slopes greater than 1 percent and areas of soils similar to Frio soil except that they are gravelly. Areas of Bosque, coarse subsoil variant, Castroville, Conalb, and Dev soils also are included.

This Frio silty clay loam is subject to a slight hazard of erosion, and runoff is slow. This soil is used mainly as range and wildlife habitat, but a few areas are cultivated mostly to small grain, grain sorghum, and introduced grasses. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. If the soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are improved bermudagrass, Kleberg bluestem, kleingrass, and blue panicum. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIc-2, dryland, and I-1, irrigated; pasture and hayland group 1C; Loamy Bottomland range site.

Frio silty clay loam, 1 to 3 percent slopes (FoB).—This gently sloping soil is on flood plains in long, narrow bands on breaks from the more level Frio soils to the stream channels. It is flooded once every 5 to 20 years, and the flooding lasts less than 2 days. Slopes are commonly 1 to 2 percent. Soil areas range from 10 to 50 acres in size.

In a representative profile of this soil, the surface layer is dark grayish-brown silty clay loam about 25 inches thick. The next layer is grayish-brown firm silty clay that is 9 inches thick. The underlying material is pale-brown clay loam that contains a few limestone pebbles.

Included with this soil in mapping are areas of Frio soil on slopes that are less than 1 percent and areas of soils that are similar to Frio except that they are gravelly. Areas of Bosque, coarse subsoil variant, Castroville, Conalb, and Dev soils also are mapped with this soil.

This Frio silty clay loam is subject to a slight hazard of erosion. Runoff is medium. This soil is used mainly as range and wildlife habitat. It is suited to cultivation if it is managed properly. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. If the soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are improved bermudagrass, Kleberg bluestem, kleingrass, and blue panicum. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIe-2, dryland, and IIe-5, irrigated; pasture and hayland group 1C; Loamy Bottomland range site.

Frio silty clay loam, frequently flooded (Fs).—This nearly level soil is on flood plains in long, narrow bands that are closer to stream channels and slightly lower than other Frio soils. This soil is flooded at least once every 1 to 5 years, and in places it is flooded more than once each year. Flooding lasts less than 2 days. Slopes range from 0 to 1 percent. In some places, the surface is slightly moundy. Soil areas range from about 25 to 150 acres in size.

In a representative profile of this soil, the surface layer is about 22 inches thick and is very dark grayish-brown silty clay loam. The next 12 inches is dark grayish-brown firm silty clay loam intermixed with a few thin strata of darker-colored silty clay loam and lighter-colored silt loam and loam. The underlying material is light brownish-gray silt loam intermixed with a few thin strata of darker-colored silty clay loam.

Included with this soil in mapping are areas of Conalb and Dev soils, areas of Frio soils that are less frequently flooded, and areas of soils similar to Frio except that they are gravelly.

This soil is used as range and wildlife habitat. It is suitable for pasture or hay, but it is not recommended for crops because of flooding. Runoff is slow.

The main adapted plants used for pasture and hayland are improved bermudagrass, Kleberg bluestem, kleingrass, and blue panicum. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit Vw-1, dryland, and Vw-1, irrigated; pasture and hayland group 1C; Loamy Bottomland range site.

Hindes Series

The Hindes series consists of undulating, moderately deep to deep, noncalcareous soils. These soils formed in very gravelly, clayey, and loamy materials.

In a representative profile the surface layer is dark reddish-brown, slightly acid, gravelly sandy clay loam that is about 8 inches thick and is about 40 percent rounded chert pebbles. The next layer, about 23 inches thick, is dark reddish-brown, slightly acid, very gravelly clay that is about 75 percent rounded chert pebbles. The underlying material is pink caliche that is about clay loam in texture, contains a few chert pebbles, and reaches to a depth of 60 inches.

These Hindes soils are used as range and wildlife habitat. They are well drained. Permeability is moderately slow, and runoff is medium. The available water capacity is low.

Representative profile of Hindes gravelly sandy clay loam, in an area of Hindes and Yologo soils, undulating, 1 mile east on U.S. Highway 90 from the courthouse in Uvalde, Tex., then 15.3 miles east on Farm Road 1023, then 0.5 mile south along fence line, then 1,000 feet east from fence line corner and 50 feet north of fence line, in range.

A1—0 to 8 inches, dark reddish-brown (5YR 3/2) gravelly sandy clay loam, dark reddish brown (5YR 2/2) moist; moderate, fine and very fine, subangular blocky structure; hard, friable; many fine roots; an estimated 40 percent, by volume, rounded chert pebbles, mainly 1/2 to 2 inches in diameter; slightly acid; clear, wavy boundary.

B21t—8 to 15 inches, dark reddish-brown (5YR 3/3) very gravelly clay, dark reddish brown (5YR 3/2) moist; moderate, fine and very fine, blocky structure; very hard, firm; many fine roots; an estimated 75 percent, by volume, rounded chert pebbles mainly 1/2 to 2 inches in diameter; clay films on peds and coarse fragments; slightly acid; gradual, wavy boundary.

B22t—15 to 31 inches, dark reddish-brown (2.5YR 3/4) very gravelly clay, dark reddish brown (2.5YR 2/4) moist; moderate, fine and very fine, blocky structure; very hard, firm; few fine roots; an estimated 7 percent, by volume, rounded chert pebbles mainly 1/2 to 2 inches in diameter; clay films on peds and coarse fragments; slightly acid; abrupt, wavy boundary.

Cca—31 to 60 inches, pink (7.5YR 7/4) caliche of clay loam texture, brown (7.5YR 5/4) moist; massive; very hard, friable; upper 2 inches is slightly harder; few, fine, distinct reddish-brown, strong-brown, and yellowish-red streaks and pockets of loamy to sandy material; few rounded chert pebbles; calcareous; moderately alkaline.

The solum ranges from 25 to 50 inches in thickness. The A horizon ranges from 4 to 12 inches in thickness, from very dark grayish brown or dark grayish brown to dark reddish brown, reddish brown, dark brown, or brown in color, and from slightly acid to mildly alkaline in reaction. The A horizon, exclusive of coarse fragments, is dominantly sandy clay loam but ranges to fine sandy loam, loam, or clay loam. It is from 10 to 50 percent, by volume, coarse fragments.

The B horizon is 35 to 80 percent, by volume, waterworn chert pebbles. The B2t horizon, exclusive of coarse fragments, ranges from clay to clay loam and is slightly acid to mildly alkaline in reaction. In some profiles the B2t horizon has threads or soft masses of calcium carbonate in the lower part. The B21t horizon ranges from 6 to 14 inches in thickness and from dark reddish brown to reddish brown or dark brown. The B22t horizon ranges from dark reddish brown to brown.

The Cca horizon is mainly soft caliche, but it ranges either to clayey material intermixed with lumps and concretions of calcium carbonate or to weakly consolidated sandstone seamed with calcium carbonate.

Hindes and Yologo soils, undulating (HYB).—This mapping unit is on undulating uplands. In most areas it is 45 percent Hindes soil, 25 percent Yologo soil, 17 percent Olmos soil, and 13 percent Randado, Valco, Webb, and Zapata soils. The percentage of Hindes soil ranges from 35 to 50 and that of Yologo soil from 20 to 30. These soils occur together without regularity of pattern. The composition of this unit is more variable than that of most other units in the county but has been controlled well enough to interpret for the expected use of the soils.

Areas are subrounded to irregular and range from 25 to about 1000 acres but are mainly 200 to 500 acres in size. Slopes range from 1 to 8 percent but are commonly about 2 to 6 percent.

The Hindes soil and the Yologo soil in this mapping unit have the profile described as representative of the Hindes and Yologo series, respectively.

These soils are well drained. Permeability is moderately slow to moderate, and runoff is medium to rapid. The available water capacity is low. Hindes soil receives extra water from the nearby Yologo soil. The gravelly surfaces of the soils in this unit help to control erosion, to reduce evaporation, and to increase infiltration. The hazard of erosion is moderate.

This mapping unit is used as range and wildlife habitat, and this is its best use. This unit contains a number of open-mine pits where materials were excavated for use in the construction of roadbeds. Capability unit for Hindes part VIs-2, dryland, for Yologo part VIIs-3, dryland; both soils in Gravelly Ridge range site

Ingram Series

The Ingram series consists of moderately deep to deep soils that are nearly level to gently sloping and hilly. These neutral soils formed on isolated hills and ridges in materials weathered from basalt and phonolite.

In a representative profile about 50 percent of the surface is covered by gravel, cobble, and stone-size fragments of basalt. The upper 4 inches of the surface layer is dark-brown clay, and the lower 11 inches is brown very firm clay intermixed with a few basalt fragments. The next layer, about 27 inches thick, is brown, very firm cobbly clay that is about 25 percent basalt fragments intermixed with a few soft masses of lime in the upper part and increasing to about 5 percent lime in the lower part. Indurated basalt is at a depth of 42 inches.

Ingram soils are well drained. Permeability is slow, and runoff is rapid. The available water capacity is high. These soils are used as range and wildlife habitat. Basaltic materials are mined from an open-pit traprock mine at Knippa, Tex.

Representative profile of Ingram clay, in an area of Ingram stony soils, hilly, 8.8 miles west of the courthouse in Uvalde, Tex., on U.S. Highway 90, then 400 yards south on an igneous hill, in range.

A11—0 to 4 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure parting to moderate, very fine and fine, blocky; very hard, firm; many fine roots; 50 percent surface cover of angular and subrounded basalt gravels, cobbles, and stones, few imbedded; neutral; clear, wavy boundary.

A12—4 to 15 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, fine and medium, blocky structure; extremely hard, very firm; many fine roots; distinct pressure faces on some peds; few angular and subrounded basalt fragments; neutral; gradual, wavy boundary.

B21—15 to 23 inches, brown (7.5YR 4/4) cobbly clay, dark brown (7.5YR 3/4) moist; moderate, fine and medium, blocky structure; extremely hard, very firm; common fine roots; distinct pressure faces on some peds; about 25 percent, by volume, angular and subrounded basalt fragments; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B22—23 to 29 inches, brown (7.5YR 5/4) cobbly clay, brown (7.5YR 4/4) moist; about 25 percent, by volume, yellowish-red (5YR 5/6) clay; weak, fine and medium, blocky structure; very hard, very firm; few fine roots; about 25 percent, by volume, angular and subangular basalt fragments; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B23ca—29 to 42 inches, brown (7.5YR 5/4) cobbly clay, brown (7.5YR 4/4) moist; weak, fine, blocky structure; very hard, very firm; about 25 percent, by volume, angular and subrounded basalt fragments; about 5 percent, by volume, soft masses of calcium carbonate; calcareous; moderately alkaline; abrupt, wavy boundary.

R—42 to 60 inches, indurated basalt; coarsely fractured.

The solum ranges from 20 to 48 inches in thickness and corresponds to the depth to indurated basalt or a bed of basalt rubble. Coarse fragments that range in size from pebbles to boulders make up 15 to 35 percent of the soil. Stones and boulders on the surface range from 15 to 70 percent coverage within a horizontal distance of a few feet.

The A horizon ranges from 10 to 24 inches in thickness, from very dark grayish brown, dark brown, or brown to reddish brown in color, and from neutral to mildly alkaline in reaction.

The B horizon ranges from 5 to 35 inches in thickness, from dark brown or brown to reddish brown in color, and from mildly alkaline to moderately alkaline in reaction. The B horizon ranges from a few to 10 percent, by volume, calcium carbonate masses.

Ingram gravelly soils, 0 to 5 percent slopes (IgC).—The nearly level to gently sloping soils in this mapping unit are near the bases of the steeper igneous hills where Ingram stony soils, hilly, are. Areas range from about 10 to 200 acres in size but are commonly 25 to 75 acres.

This mapping unit is about 50 percent Ingram gravelly soils, 40 percent soils similar to Knippa, Montell, Tobosa, and Uvalde soils except that they generally have basalt fragments on their surfaces, and 10 percent other soils. The soil patterns are not uniform, and the soils similar to Knippa, Montell, Tobosa, and Uvalde soils are not in all mapped areas. Ingram stony soils and soils that are very gravelly or very stony throughout the soil profile are also in this unit.

Ingram gravelly soils have a surface layer of dark brown gravelly clay about 3 inches thick. It is about 15 percent basalt fragments in the soil mass and has a cover of 35 percent basalt fragments. The next layer, about 21 inches thick, is reddish-brown very firm clay that is about 10 percent basalt fragments. Below this is about 14 inches of reddish-brown very firm clay that is about 10 percent basalt fragments increasing to 30 percent in the lower 4 inches. It is also about 10 percent concretions and lumps of lime. The underlying material is igneous rubble.

Runoff is rapid. In most places Ingram gravelly soils receive runoff from the steeper Ingram soils. The hazard of erosion is moderate. The coarse basalt fragments on the surface help to control erosion and to reduce evaporation. Capability unit VIIs-4, dryland; Igneous Hill range site.

Ingram stony soils, hilly (InD).—The soils in this mapping unit are on scattered, isolated, igneous hills and ridges. This unit is about 70 percent Ingram stony soils, 10 percent very gravelly clay loam overlying loose beds of igneous fragments, 10 percent of a soil similar to Ingram soils except that it is less than 20 inches deep over bedrock, and 10 percent soils that have accumulations of lime above the bedrock, or gravelly clay soils similar to the Ingram soils. These soil patterns are not uniform. Small rock outcrops near the caps of the hills are also in this unit.

Areas are subrounded and range from 5 to about 500 acres in size but are mostly 100 to 200 acres. Slopes range from 8 to 30 percent but are most commonly 10 to 20 percent. Smaller areas are less sloping than larger ones.

Ingram stony soils, hilly, have the profile described as representative of the Ingram series.

Runoff is rapid, and the hazard of erosion is high. Coarse basalt fragments on the surface help to control erosion and reduce evaporation. Capability unit VIIs-4, dryland; Igneous Hill range site.

Kavett Series

The Kavett series consists of nearly level to gently sloping, shallow, calcareous soils on uplands. These soils formed in materials weathered from beds of limestone and limestone interbedded with chalks and marls.

In a representative profile the surface layer is clay about 16 inches thick. It is dark brown and firm in the upper part and reddish brown and very firm in the lower part. The underlying material is about 2 inches of pale-brown strongly cemented caliche. Below this is yellowish limestone and marl.

Kavett soils are well drained. Permeability is moderately slow, and runoff is slow. The available water capacity is low. These soils are used as range and wildlife habitat.

Representative profile of Kavett clay, 0 to 3 percent slopes, 1.1 miles northeast of Utopia, Tex., on a county road, then 200 feet north of right-of-way, in range.

A11—0 to 7 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, very fine and fine, subangular blocky structure; very hard, firm; many fine roots; few fine pores and old root channels; few fine limestone fragments up to one-half inch in diameter; calcareous; moderately alkaline; gradual, smooth boundary.

A12—7 to 16 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate, fine and medium, subangular blocky structure parting to moderate, very fine, granular and very fine blocky; very hard, very firm; many fine roots; few fine pores and old root channels; few limestone fragments mainly 1 to 5 millimeters in size; calcareous; moderately alkaline; abrupt, smooth boundary.

Ccam—16 to 18 inches, pale-brown (10YR 6/3) strongly cemented caliche, fractured into plates; dark reddish-brown (5YR 3/3) clay in cracks makes up about 10 percent, by volume; calcareous; moderately alkaline; abrupt, smooth boundary.

R—18 to 36 inches, yellowish limestone and marl with upper one-fourth inch as coating of indurated calcium carbonate; contains indurated limestone fragments; calcareous.

The solum ranges from 13 to 20 inches in thickness. The All horizon ranges from 5 to 10 inches in thickness and from dark brown to very dark grayish brown. The A12 horizon ranges from 5 to 10 inches in thickness and from grayish brown or brown to reddish brown. The Ccam ranges from 1 to 6 inches in thickness. The R layer ranges from indurated limestone to interbedded limestone, chalks, and marls.

Kavett clay, 0 to 3 percent slopes (KaB).—This soil is on uplands, mainly between the steeper limestone hills and the drainageways. Areas are irregular in shape and in most places are longer than they are wide. They range from 20 to 200 acres in size but are mainly 50 to 100 acres. Slopes are mainly 0.5 to 2.5 percent.

Included with this soil in mapping are areas of a soil similar to Kavett clay except that it is gravelly or stony. Less extensive areas of Pratley, Speck, and Topia soils also are included.

This Kavett clay is used mainly as range and wildlife habitat. A few small fields have been planted to small grain for wildlife. This soil is suited to cultivation if it is managed properly.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture, especially on slopes greater than 1 percent. If this soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are King Ranch bluestem and Kleberg bluestem. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIe-6, dryland, and IIIe-1, irrigated; pasture and hayland group 13A; Shallow range site of the Edwards Plateau.

Knippa Series

The Knippa series consists of nearly level to gently sloping, deep, calcareous soils on uplands. These soils formed in clayey and loamy materials on outwash plains.

In a representative profile the surface layer is dark grayish-brown clay in the upper 8 inches and brown very firm clay in the lower 10 inches. The next layer, about 17 inches thick, is very firm clay. It is reddish brown and a few lime concretions are intermixed in the upper part, and it is brown and about 5 percent lime concretions in the lower part. The underlying material extending to a depth of 48 inches is light-brown clay loam that is about 30 percent concretions and soft masses of lime. Below this it is pink clay loam that is about 20 percent concretions and soft masses of lime.

Knippa soils are well drained. Permeability is moderately slow, and runoff is slow to medium. The available water capacity is high.

These Knippa soils are well suited to cultivation, especially where irrigated. Large tracts are cultivated, some fields also are used for pasture and hay, and the rest is used as range and wildlife habitat.

Representative profile of Knippa clay, 0 to 1 percent slopes, 3.9 miles east of Knippa, Tex., on U.S. Highway 90, then 0.1 mile north across a railroad track, in a cultivated field.

Ap—0 to 8 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; very hard, firm but crumbly; many fine roots; upper 1 inch is loose flattened granules; few, fine, strongly cemented calcium carbonate concretions up to 1 millimeter in size; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—8 to 18 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, fine and very fine, blocky structure; extremely hard, very firm; many fine roots; few fine pores and old root channels; few worm casts; shiny pressure faces on peds; few strongly cemented calcium carbonate concretions up to 3 millimeters in size; some organic staining on few peds; calcareous; moderately alkaline; gradual, wavy boundary.

B21—18 to 28 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate, fine and very fine, blocky structure; extremely hard, very

firm; few fine roots and old root channels; few fine pores; few worm casts; shiny pressure faces on peds; few strongly cemented calcium carbonate concretions up to 3 millimeters in size; organic staining on few peds; calcareous; moderately alkaline; gradual, wavy boundary.

B22ca—28 to 35 inches, brown (7.5YR 4/4) clay, brown (7.5YR 4/4) moist; moderate, fine, blocky structure; extremely hard, very firm; very few roots; few old root channels and fine pores; an estimated 5 percent, by volume, strongly cemented calcium carbonate concretions up to 15 millimeters in size; some organic staining on few peds; calcareous; moderately alkaline; gradual, wavy boundary.

C1ca—35 to 48 inches, light-brown (7.5YR 6/4) clay loam; brown (7.5YR 5/4) moist; massive; hard, friable; an estimated 30 percent, by volume, cemented concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

C2ca—48 to 60 inches, pink (7.5YR 7/4) clay loam, reddish yellow (7.5YR 6/6) moist; massive; hard, friable; an estimated 20 percent, by volume, soft masses and cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 24 to 40 inches in thickness. When these soils are dry, they have cracks from 1/4 to 1 inch wide that extend from the surface to depths of about 36 inches. A few limestone fragments are in the solum and gravel is at depths below 48 inches in places.

The A horizon ranges from 12 to 28 inches in thickness and from dark grayish brown or dark brown to brown or reddish brown. The B2 horizon ranges from 8 to 27 inches in thickness and from brown or reddish brown to yellowish red. The C horizon ranges from reddish yellow or pink to light yellowish brown or light brown. Soft masses and weakly to strongly cemented concretions of calcium carbonate make up from 15 to 40 percent, by volume, of the C1ca horizon.

Knippa clay, 0 to 1 percent slopes (KnA).—This nearly level soil is on uplands, in broad and slightly irregularly shaped bands. Most areas are more than 300 acres in size, and some areas are several thousand acres. Slopes are mainly less than 0.5 percent.

This soil has the profile described as representative of the Knippa series.

Included with this soil in mapping are areas of Montell, Tobosa, and Uvalde soils and a few spots of Olmos and Valco soils. Areas of Knippa clay, 1 to 3 percent slopes, are close to drainageways.

This Knippa clay is subject to a slight hazard of erosion, and runoff is slow. About one-half of this soil is cultivated, and about one-fourth of the cultivated acreage is irrigated. Small grains, grain sorghums, and introduced grasses are the main dryland crops.

These same crops, and cotton, corn, and many kinds of truck crops are irrigated. Scattered fields are used for pasture and hay, and the remainder of this soil is used as range and wildlife habitat.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. A well-designed irrigation system and proper water management are needed if this soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, blue panicum, and Kleberg bluestem. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are important. Capability unit IIs-1, dryland, and IIs-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

Knippa clay, 1 to 3 percent slopes (KnB).—This gently sloping soil is on uplands, in long, narrow areas that are parallel to small drains. Areas are mainly on slope breaks between the more level Knippa soils and small drains and are less than 100 acres in size. Slopes are mainly less than 2 percent.

In a representative profile of this soil, the surface layer is dark grayish-brown clay in the upper 10 inches and brown very firm clay in the lower 6 inches. The next layer is reddish-brown very firm clay in the upper 8 inches and brown clay that is about 2 to 3 percent concretions and soft masses of lime in the lower 10 inches. The underlying material, extending to a depth of 60 inches, is reddish-yellow clay that is about 25 percent concretions and soft masses of lime.

Included with this soil in mapping are a few narrow areas where slopes are greater than 3 percent and areas of Knippa clay, 0 to 1 percent slope. Areas of Sabenyo and Uvalde soils and small eroded spots also are included.

This Knippa clay is subject to a moderate hazard of erosion. Runoff is medium. This soil is used mostly as range and wildlife habitat. A small acreage that is adjacent to the more level Knippa soils is cultivated. Small grain, sorghums, and introduced grasses are the main dryland crops. Cotton, corn, and a few truck crops are grown in irrigated areas.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed if this soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, blue panicum, and Kleberg bluestem. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are important. Capability unit IIe-3, dryland, and IIe-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

Limestone Rock Land

Limestone rock land (LS) consists of areas where slopes range from 20 to 40 percent but are commonly 25 to 40 percent. On caps of hills, slopes may be as little as 5 percent (fig. 18). About 50 to 70 percent of the land surface is sloping ledges of exposed limestone bedrock on the contour around the hills. These exposed ledges range from about 10 to about 50 feet in width and from about 10 to about 50 feet apart. In many places the bedrock is covered with a 1- to 2-inch layer of soil material.

Ector soils are mostly between the exposures of bedrock. These very shallow soils are covered, from about 25 to as much as 90 percent, by limestone pebbles, cobbles, stones, and boulders and some chert pebbles and cobbles. These Ector soils have a dark-brown stony clay loam surface layer about 10 inches thick. They are more than 35 percent coarse fragments in the solum and have indurated fractured limestone within 20 inches of the surface. Ector soils account for about 30 to 40 percent of the mapped areas.

Included with Limestone rock land in mapping are smaller areas of a soil similar to Ector except that it contains less than 35 percent coarse fragments in the profile and pockets of Kavett soils on the narrow caps of the hills. Dev, Kavett, Pratley, San Saba, Speck, Topia, and Volente soils are along the small drains in the narrow valleys between the steeper slopes.

The composition of this unit is more variable than that of most other units in the county but has been controlled well enough to interpret for the expected use of the soils.

A representative area of Limestone rock land is located 15.3 miles north on U.S. Highway 83 from its junction with Texas Highway 55, at the north edge of Uvalde.

Ector soils are well drained, and their permeability is moderate. The available water capacity is low, and runoff is rapid. The hazard of erosion is high.

Limestone rock land is used as range and wildlife habitat. Capability unit VIIIs-1, dryland; Rocky Hill range site.

Figure 18a.—Area of Limestone rock land. Limestone is ledged on the contour.

Figure 18b.—Area of Limestone rock land. Areas of Ector soils are between limestone exposures.

Mercedes Series

The Mercedes series consists of deep calcareous soils that are level or nearly level. These soils formed in clayey materials in small depressed areas and narrow drains.

In a representative profile the surface layer is gray very firm clay about 29 inches thick. The next layer, about 34 inches thick, is grayish-brown to light brownish-gray very firm clay that has streaks and tongues of darker clay and a few flecks of brownish clay. The underlying material is very pale brown clay that reaches to a depth of 74 inches.

Mercedes soils are moderately well drained. Permeability is very slow, and runoff is very slow to slow. The available water capacity is high.

These soils are used mostly as range and wildlife habitat. A few small areas are cultivated.

Representative profile of Mercedes clay, 3.2 miles west of the courthouse in Uvalde, Tex., on U.S. Highway 90, then 2.2 miles north on Farm Road 2369, then west along fence line 1,500 feet and 50 feet north, in a low area.

A11—0 to 10 inches, gray (10YR 6/1) clay, dark gray (10YR 4/1) moist; weak, fine, blocky structure but nearly massive; extremely hard, very firm, very sticky and very plastic; very few roots; few dark organic stains; calcareous; moderately alkaline; gradual, smooth boundary.

A12—10 to 29 inches, gray (10YR 6/1) clay, dark gray (10YR 4/1) moist; moderate, fine and medium, blocky structure; extremely hard, very firm, very sticky and very plastic; very few fine roots; few dark organic stains; intersecting slickensides; slightly shiny ped faces; calcareous; moderately alkaline; gradual, smooth boundary.

AC1—29 to 47 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate, fine and medium, blocky structure; extremely hard, very firm, very sticky and very plastic; intersecting slickensides; few streaks or tongues of darker clay; few strongly cemented calcium carbonate concretions 1 to 2 millimeters in size in lower part; few small flecks of brownish clay; calcareous; moderately alkaline; diffuse, smooth boundary.

AC2—47 to 63 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; weak, fine and medium, blocky structure; extremely hard, very firm, very sticky and very plastic; intersecting slickensides; few streaks or tongues of darker clay; few small flecks of brownish clay; few hard calcium carbonate concretions up to 3 millimeters in size; calcareous; moderately alkaline; diffuse, wavy boundary.

C—63 to 74 inches, very pale brown (10YR 7/3) clay, pale brown (10YR 6/3) moist; massive; very hard, very firm, very sticky and very plastic; calcareous; moderately alkaline.

The solum ranges from about 48 to 72 inches in thickness. Salinity generally increases with depth and ranges from free to moderately affected. Accumulations of calcium carbonate, gypsum, and other salts in the form of soft masses and concretions range from few to common.

The A horizon is gray or light gray. The AC horizon is grayish brown, light brownish gray, brown, or pale brown. The C horizon is very pale brown, pale brown, or light brownish gray.

Mercedes clay (Me).—This level or nearly level soil is in small depressed areas and narrow drains. These depressed areas are mainly 2 to 5 feet lower than the surrounding soils, are subrounded to oblong, and are about 3 to 15 acres in size. The

areas in drains are 3 to 10 feet lower than the surrounding soils, are long and narrow, and are mainly 25 to about 250 acres in size.
This soil receives runoff from surrounding areas. Because surface drainage is inadequate and internal drainage is slow, water is ponded for periods of 1 to 3 weeks after heavy rains. The ponding of water along the narrow drains is intermittent.

Included with this soil in mapping are areas that are a darker gray color and a few areas where water is ponded for longer than 1 to 3 weeks. Along some of the drains, a few soils having slopes of 1 to 3 percent also are included.

A small acreage of this Mercedes clay is cultivated mainly to grain sorghum and small grain. Young crops are frequently flooded, and the high moisture content of the soil after rain makes tillage and harvesting operations difficult.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. If this soil is irrigated, a well-designed irrigation system and proper water management are needed. Diversion terraces are useful in some places.

The main adapted plants used for pasture and hay are improved bermudagrass and introduced bluestems. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are important. Capability unit IVw-1, dryland, and IVw-1, irrigated; pasture and hayland group 7A; Clay Flat range site.

Montell Series

The Montell series consists of nearly level to gently sloping, deep, calcareous soils on uplands. These soils formed in clayey alluvium on outwash plains.

In a representative profile the surface layer is gray clay about 32 inches thick. The next layer, about 26 inches thick, is grayish-brown to light brownish-gray very firm clay intermixed with a few narrow tongues of darker clay in the lower part. The underlying material is very pale brown clay that is about 5 percent concretions and soft masses of lime and reaches to a depth of about 72 inches.

These Montell soils are moderately well drained. Permeability is very slow, and runoff is very slow to medium. The available water capacity is high. Scattered small depressions are on the surface in areas that have never been plowed. When these soils are dry, cracks about 1/2 to 2 inches wide form on the surface and penetrate several feet into the soil. Water enters the soil rapidly when these cracks are open but very slowly after the soil becomes wet and the crack close.

Montell soils are used as range and wildlife habitat. Some areas are cultivated and irrigated.

Representative profile of Montell clay, 0 to 1 percent slopes, 3.2 miles west of the courthouse in Uvalde, Tex., on U.S. Highway 90, then 2.2 miles north on Farm Road 2369, then west along fence 1 mile, then north along fence 0.7 mile, then 500 feet west on small ranch road and 100 feet north, in range.

A11—0 to 8 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; weak, fine, blocky and fine, subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; calcareous; moderately alkaline; clear, smooth boundary.

A12—8 to 32 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, medium, blocky structure; extremely hard, very firm, very sticky and very plastic; common fine roots; distinct intersecting slickensides and shiny ped faces in lower part; calcareous; moderately alkaline; diffuse, wavy boundary.

AC1—32 to 48 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate, medium, blocky structure; extremely hard, very firm,

very sticky and very plastic; few fine roots; distinct intersecting slickensides and shiny ped faces; few, fine, hard calcium carbonate concretions 1 to 3 millimeters in size; calcareous; moderately alkaline; saline; diffuse, wavy boundary.

AC2—48 to 58 inches, light brownish-gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; weak, fine and medium, blocky structure; extremely hard, very firm; very few fine roots; distinct intersecting slickensides; few narrow tongues and old root channels filled with darker clay; few fine calcium carbonate concretions 1 to 3 millimeters in size; calcareous; moderately alkaline; slightly saline; gradual, wavy boundary.

Cca—58 to 72 inches, very pale brown (10YR 7/4) clay, light yellowish brown (10YR 6/4) moist; extremely hard, very firm; few narrow tongues and old root channels filled with darker clay; an estimated 5 percent, by volume, strongly cemented concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; saline.

The solum ranges from 40 to 54 inches in thickness. In areas that have never been plowed, the gilgai relief is microknolls that are 4 to 12 inches higher than the microdepressions. The microdepressions range from a few feet to 25 or 30 feet wide. Conductivity of the saturation extract ranges from 4 millimhos to 12 millimhos below a depth of 24 inches. Conductivity is generally less than 4 millimhos above the 24-inch depth. A few coarse fragments of chert, limestone, or basalt are in some profiles, and a few brownish mottles are in the lower part of the solum in places.

The A horizon ranges from 14 to 37 inches in thickness and from light gray or gray to dark gray. The AC horizon ranges from light brownish gray to brown or grayish brown. The C horizon is from about 1 percent to 10 percent visible calcium carbonate or gypsum crystals.

Montell clay, 0 to 1 percent slopes (MoA).—This nearly level soil is on uplands on old outwash plains. Soil areas are broad and slightly irregular or subrounded and range from about 50 to 300 acres in size. Most areas are about 150 acres in size. Slopes are mainly less than 0.5 percent.

This soil has the profile described as representative of the Montell series.

Included with this soil in mapping are narrow areas that are next to small drains and have slopes greater than 1 percent. Small gravelly areas and less extensive areas of Knippa, Mercedes, San Saba, Tobosa, and Uvalde soils also are included.

Runoff is very slow, and this Montell clay is subject to a slight hazard of erosion.

Grain sorghum, small grain, and introduced grasses are the main dryland crops. This soil is suited to irrigation (fig. 19). Many kinds of truck crops, cotton, corn, grain sorghum, small grain, and introduced grasses are grown where the soil is irrigated.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. If the soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are improved bermudagrass and introduced bluestem. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are important. Capability unit IVs-1, dryland, and IIs-3, irrigated; pasture and hayland group 7A; Clay Flat range site.

Montell clay, 1 to 3 percent slopes (MoB).—This gently sloping soil is on uplands on old outwash plains, in long, narrow bands that are parallel to drains. Soil areas are mainly between larger areas of Montell clay, 0 to 1 percent slopes, or on

Figure 19.—Harvesting irrigated carrots on a Montell clay.

breaks into small drains. Areas are commonly less than 50 acres in size, and slopes are mainly 1 to 2 percent.

In a representative profile of this soil, the surface layer is gray very firm clay about 17 inches thick. The next layer, about 31 inches thick, is grayish-brown very firm clay that has a few narrow tongues of darker gray clay. The underlying material is very pale brown clay that is about 5 percent soft masses and concretions of lime, has few narrow tongues of darker clay, and reaches to a depth of 60 inches.

Included with this soil in mapping are areas of Montell clay, 0 to 1 percent slopes, and gravelly areas. Knippa, San Saba, Tobosa, and Uvalde soils are also included.

Runoff is medium, and this Montell clay is subject to a moderate hazard of erosion. Only a small acreage of this soil is cultivated, and the acreage that is cultivated is mainly adjacent to larger areas of the more level Montell soils. Grain sorghums, small grain, and introduced grasses are the main dryland crops. Cotton, corn, and truck crops are also grown where the soil is irrigated.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. Where the soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are improved bermudagrass and introduced bluestems. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IVe-1, dryland, and IIIe-2, irrigated; pasture and hayland group 7A; Clay Flat range site.

Olmos Series

The Olmos series consists of undulating, very shallow to shallow soils on uplands These calcareous soils formed in beds of caliche.

In a representative profile, the surface layer is dark-grayish brown gravelly loam that is about 13 inches thick and is 60 percent caliche fragments in the upper part and 75 percent in the lower part. A few chert fragments are also in the profile. The underlying material is caliche that is indurated in the upper It inch and weakly cemented below.

Olmos soils are well drained. Permeability is moderate, and runoff is medium. The available water capacity is low.

These soils are used as range and wildlife habitat. They are also used as sources for the mining of caliche for construction, and many pits are in the mapped areas.

Representative profile of Olmos gravelly loam, in an area of Olmos soils, undulating, 1 mile east of the courthouse in Uvalde, Tex., on U.S. Highway 90, then 5 miles east on Farm Road 1023, then 100 feet south and 55 feet west of metal gate, in range.

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; slightly hard, friable; many fine roots; about 60 percent, by weight, indurated caliche fragments, 10 percent that are larger than 3 inches and 30 percent that are smaller than 3/4 inch in diameter; few chert fragments; surface crust 1/4 inch thick that is lighter in color; calcareous; moderately alkaline; clear, wavy boundary.

A12—5 to 13 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky and granular structure; slightly hard, friable; many fine roots; about 75 percent, by weight, platy caliche fragments, 35 percent that are larger than 3 inches and 20 percent that are smaller than 3/4 inch in diameter; most of the fragments are indurated and laminar in the upper 14 to 1/2 inch and slightly knobby or pisolitic on the lower side; calcareous; moderately alkaline; abrupt, wavy boundary.

C1cam—13 to 14 inches, indurated white (10YR 8/2) caliche that has a hardness of more than 3 on Mohs' scale and is laminar in the upper 1/4 inch; gradual, wavy boundary.

C2ca—14 to 26 inches, whitish to pinkish caliche; weekly cemented; few, fine, yellowish-brown mottles in lower part; few chert pebbles.

The solum to indurated caliche ranges from 7 to 20 inches in thickness. This range is common within horizontal distances of less than 20 feet. The surface cover is from less than 5 percent to 75 percent coarse fragments, and this range occurs within 10 linear feet in some places.

The A horizon ranges from very dark grayish brown or dark grayish brown to grayish brown and is 35 to 75 percent caliche fragments. A few limestone and chert fragments are in some profiles. This horizon, exclusive of coarse fragments, ranges from loam to clay loam. The All horizon ranges from 3 to 8 inches in thickness. The A12 horizon ranges from 4 to 10 inches in thickness and has most of the coarse fragments. Many of these fragments are indurated and laminar in the upper part and knobby or pisolitic on the lower side.

The Cca horizon has limestone or chalk fragments in some profiles. The C1cam horizon ranges from about 1 to 5 inches in thickness and is indurated and laminar. The C2ca horizon ranges from weakly to strongly cemented caliche. In some profiles, this horizon is a few to 75 percent rounded chert and other gravel.

Olmos soils, undulating (OLB).—This mapping unit consists of undulating soils on low ridges. About 74 percent of this unit is Olmos soils, but this percentage ranges from 42 to 90. About 15 percent is soils similar to Olmos soils except that they are not underlain by strongly cemented or indurated caliche. The percentage of these soils ranges from 10 to 25. From 7 to 11 percent of this unit is soils that are similar to Olmos soils except they do not have caliche fragments above the indurated layer. The soils in this unit do not occur in a uniform pattern. The composition of this unit is more variable than that of most other units in the county but has been controlled well enough to interpret for the expected use of the soils.

Most areas are irregular and range from about 5 to more than 500 acres in size. Areas are mostly 50 to 150 acres in size. Slopes range from 1 to 8 percent but are mainly 2 to 5 percent. Slopes are short and smooth, and surfaces are convex and concave.

Olmos soils have a profile similar to that described as representative of the Olmos series, except that the surface layer is gravelly loam or gravelly clay loam.

Included in this mapping unit are areas of Ector, Uvalde, Valco, Yologo, and Zapata soils.

This mapping unit is subject to a moderate hazard of erosion. On denuded range, erosion is active. Capability unit VIIs-5, dryland; Shallow Ridge range site.

Olmos and Ector soils, undulating (OMB).—This mapping unit consists of undulating soils on uplands. A mapped area averages about 45 percent Olmos soils, 44 percent Ector soils, and 11 percent Dev, Kavett, Uvalde, Valco, and Zapata soils. The percentage of Olmos soils ranges from 25 to 60 and that of Ector soils from 20 to 65. The composition of this unit is more variable than that of most other units in the county but has been controlled well enough to interpret for the expected use of the soils.

Olmos soils are mainly in lower parts of the undulating landscape but are on ridgetops in places. Ector soils are mainly in the higher positions but extend down the gentle side slopes. Although these soils are together without regularity of pattern, they could have been mapped separately. Because these soils have similar uses and management, separate mapping was not justified.

Areas of this mapping unit are irregular in shape and range from about 20 to more than 1,000 acres in size. Slopes range from 1 to 8 percent but are mainly 2 to 5 percent. They are short and smooth, and some are convex and others concave.

Olmos soils have a surface layer of dark grayish-brown gravelly loam about 10 inches thick. It is about 35 percent caliche and limestone fragments in the upper 4 inches and about 75 percent in the lower 6 inches. The underlying material is caliche that reaches to a depth of 27 inches and is indurated in the upper 1 inch and weakly cemented below.

Ector soils have a surface layer of very dark grayish brown very gravelly loam about 9 inches thick that is about 70 percent limestone fragments. A few stones are on the surface. The underlying material is indurated limestone that has a very thin lime coating.

This mapping unit is well drained. Permeability is moderate, and runoff is medium to rapid. Because the available water capacity is low, the soils are droughty. The hazard of erosion is moderate. Erosion is especially active on denuded range. Capability unit for Olmos part VIIs-5, dryland, and for Ector part VIIs-2, dryland; Both soils in Shallow Ridge range site.

Orif Series

The Orif series consists of nearly level calcareous soils on bottom lands. These soils are shallow to gravel and very deep to hard rock.

In a representative profile the surface layer is light brownish-gray fine sandy loam that is about 12 percent limestone pebbles and is about 12 inches thick. The upper 28 inches of the underlying material is very pale brown very gravelly sand that is about 90 percent limestone pebbles and has a few strata of sandy loam.

The lower part is very pale brown sand that reaches to a depth of 80 inches and has a few limestone pebbles and cobbles and a few strata of sandy loam (fig. 20).

Orif soils are well drained. Permeability is rapid, and runoff is slow. The available water capacity is low. These soils are flooded once every 1 to 5 years, but flooding lasts less than 2 days.

These soils are used as range and wildlife habitat. Sand and gravel are mined from open pits in a few places.

Representative profile of Orif fine sandy loam, in an area of Orif soils, 2.8 miles north on Farm Road 187 from its intersection with U.S. Highway 90 in Sabinal, Tex., and 0.5 mile west on a ranch road.

A1—0 to 12 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; slightly hard, very friable; common fine roots; few root channels; about 2 percent water-rounded limestone pebbles; calcareous; moderately alkaline; abrupt, smooth boundary.

IIC1—12 to 40 inches, very pale brown (10YR 7/4) very gravelly sand, light yellowish brown (10YR 6/4) moist; single grained; loose, soft; few roots; an estimated 90 percent, by volume, water-rounded limestone pebbles and few cobbles; few very thin strata of sandy loam; calcareous; moderately alkaline; abrupt, smooth boundary.

IIIC2—40 to 80 inches, very pale brown (10YR 7/3) sand, light yellowish brown (10YR 6/4) moist; single grain; loose, soft; few roots; an estimated 2 percent water-rounded limestone pebbles and cobbles; few very thick strata of sandy loam; calcareous; moderately alkaline.

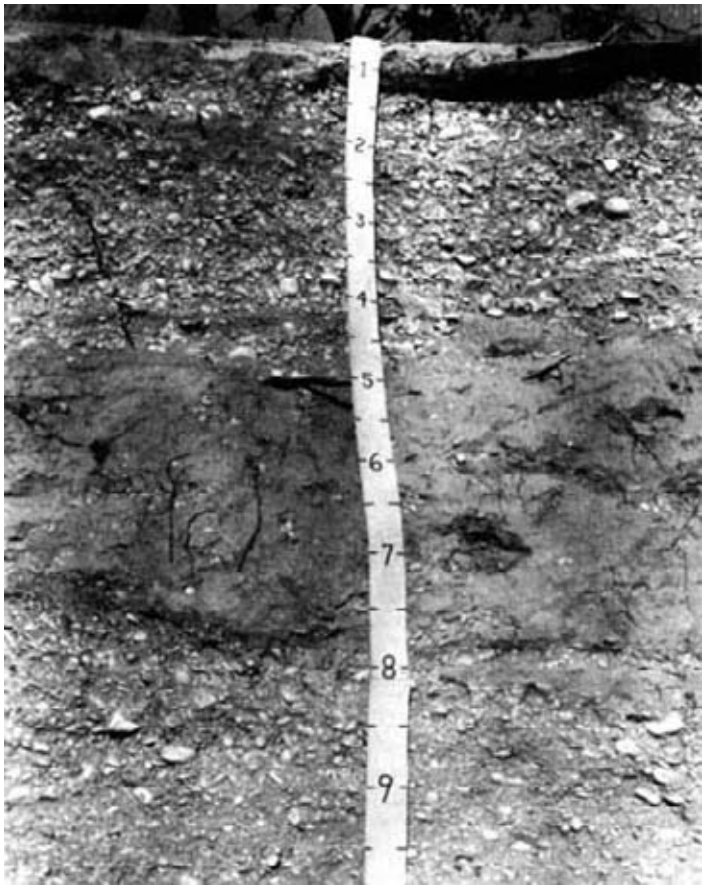

Figure 20.—Profile of an Orif soil.

The soil ranges from 50 to 100 inches or more in thickness and is from 40 to 80 percent, by volume, carbonates that are smaller than 20 millimeters. Strata of mainly coarse fragments are common throughout the soil. Discontinuous strata of sand, loamy sand, and light fine sandy loam that are practically free of gravel occur at depths between 10 to 40 inches in some places.

The A horizon ranges from 6 to 18 inches in thickness, from grayish brown to light brownish gray in color, and exclusive of coarse fragments, from loam to loamy fine sand in texture. The A horizon has a few to as much as 25 percent, by volume, limestone pebbles.

The C horizon ranges from pale brown to very pale brown or light brownish gray. The fine earth fraction of the IIC1 horizon ranges from loamy sand to sand in texture. The IIC1 horizon has a few cobbles and stones and is from 35 to 90 percent, by volume, limestone pebbles that are less than 3 inches in diameter.

Orif soils (Or).—These nearly level soils are on the flood plains of streams, in long, narrow bands parallel to and about 5 to 25 feet above stream channels. Slopes are dominantly 0.2 to 1 percent, and the soils are moundy in many places. The texture of the fine earth fraction of the surface ranges from loam to loamy fine sand. Areas range from about 20 to 150 acres in size but are mainly about 50 to 75 acres.

Included with these soils in mapping are a few areas of Bosque, coarse subsoil variant, Goliath, Dev, and Frio soils. Soils that are similar to Orif soils except they have more clayey lower layers are also included.

These Orif soils are often changed by flooding. Many of them are covered after light flooding, and almost all of them are covered by heavy flooding. Capability unit VIw–1, dryland; Loamy Bottomland range site.

Pratley Series

The Pratley series consists of nearly level to gently sloping, moderately deep soils on uplands. These soils formed in clayey materials overlying limestone of variable hardness.

In a representative profile the surface layer is very dark grayish-brown calcareous clay about 8 inches thick. The next layer is about 27 inches of reddish-brown very firm clay. The underlying material is 4 inches of broken fragments of indurated caliche that is about 15 percent reddish-brown clay between the fragments and resting on 1 inch of indurated caliche. Below a depth of 40 inches is white limestone, chalk, and marl.

Pratley soils are well drained. Permeability is moderately slow, and runoff is slow to medium. The available water capacity is high.

These soils are used mainly as range and wildlife habitat. A small acreage is cultivated.

Representative profile of Pratley clay, 0 to 3 percent slopes, 2.45 miles west on Farm Road 1050 from its junction with Farm Road 187 in Utopia, Tex., then 120 feet north of right-of-way, in range.

A11—0 to 8 inches, very dark grayish-brown (10YR 312) clay, very dark brown (10YR 2/2) moist; moderate, fine, subangular blocky and granular structure; very hard, firm; many fine roots; few fine pores and old root channels; few fine limestone fragments; calcareous; moderately alkaline; clear, smooth boundary.

B21t—8 to 24 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate, medium, subangular blocky structure parting to moderate, very fine, blocky; very hard, very firm; many fine roots; few fine pores and old root channels; common clay films on peds; few fine limestone and caliche fragments; calcareous; moderately alkaline; gradual, smooth boundary.

B22t—24 to 35 inches, reddish-brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate, medium, subangular blocky structure parting to moderate, very fine, blocky; very hard, very firm; few fine roots; common clay films on peds; few fine limestone and caliche fragments; calcareous; moderately alkaline; abrupt, wavy boundary.

C1cam—35 to 39 inches, broken fragments of indurated caliche in a horizontal position that are 1/4 to 1 inch thick and 3 to 10 inches wide; reddish-brown (5YR 5/4) clay in the space between the fragments makes up about 10 to 15 percent of the layer; calcareous; moderately alkaline; abrupt, wavy boundary.

C2cam—39 to 40 inches, indurated caliche that is pitted on the upper surface and laminar in the upper part; abrupt, wavy boundary.

R—40 to 54 inches, white (10YR 8/2) and very pale brown (10YR 7/3) limestone, chalk, and marl.

The solum ranges from 22 to 40 inches in thickness to a cemented caliche layer. The A horizon ranges from 7 to 15 inches in thickness, from very dark grayish brown or dark grayish brown to dark brown in color, and from neutral through moderately alkaline in reaction.

The B2t horizon ranges from reddish brown to brown or dark brown in color and from mildly alkaline through moderately alkaline in reaction. The Ccam horizon ranges from a 1-inch layer of indurated caliche to about 11 inches of broken indurated caliche plates containing up to 15 percent soil material between the plates. The R layer ranges from weakly consolidated limestone to interbedded chalk, marl, and indurated limestone.

Pratley clay, 0 to 3 percent slopes (PrB).—This soil is on uplands, between the steeper limestone hills and the drainageways. Soil areas are irregular and range from about 15 to 150 acres in size and are longer than they are wide. Slopes are mainly 1 to 3 percent.

Included with this soil in mapping are areas where slopes are greater than 3 percent and less extensive areas of Eckrant, Kavett, Knippa, Speck, Tobosa, and Topia soils.

This Pratley clay is used mostly as range and wildlife habitat. A few fields are cultivated mainly to small grain and grain sorghums. This soil is suited to cultivation, especially if irrigated. The hazard of erosion is slight on more level areas and moderate on sloping areas.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture, especially where slopes are greater than 1 percent. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, kleingrass, indiangrass, switchgrass, weeping lovegrass, King Ranch bluestem, and Kleberg bluestem. Proper fertilization, weed control, and controlled grazing are important management needs of good pastures. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIe-3, dryland, and IIe-2, irrigated; pasture and hayland group 7C; Deep Upland range site.

Ramadero Series

The Ramadero series consists of deep nearly level soils on uplands. These soils formed in loamy alluvium or wind-deposited materials several feet deep.

In a representative profile the surface layer is very dark grayish-brown sandy clay loam about 19 inches thick. The next layer is about 20 inches of firm sandy clay loam

that is dark brown in the upper part and brown and calcareous in the lower part. The underlying material is pale-brown calcareous sandy clay loam that is about 15 percent weakly to strongly cemented lime concretions and reaches to a depth of 60 inches.

Ramadero soils are well drained. Permeability is moderate, and runoff is slow. The available water capacity is high.

These soils are used as range and wildlife habitat. They are well suited to cultivation.

Representative profile of Ramadero sandy clay loam, 1.4 miles south of the courthouse in Uvalde, Tex., on Farm Road 117, then 9.9 miles southeast on Farm Road 140 to Kincaid Ranch Gate No. 14, then 0.5 mile south of gate and 100 feet northeast of fence line corner, in range.

A11—0 to 12 inches, very dark grayish-brown (10YR 3/2) sandy clay loam, black (10YR 2/1) moist; weak, fine and medium, subangular blocky structure; hard, friable; many fine roots; few fine pores and old root channels; mildly alkaline; clear, smooth boundary.

A12—12 to 19 inches, very dark grayish-brown (10YR 3/2) sandy clay loam, black (10YR 2/1) moist; weak, fine and medium, subangular blocky structure; hard, friable; many fine roots; few fine pores and old root channels; few threads of segregated calcium carbonate; noncalcareous; moderately alkaline; clear, smooth boundary.

B1t—19 to 28 inches, dark-brown (10YR 3/3) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, blocky structure; very hard, firm; few fine roots, fine pores, and old root channels; few thin clay films; noncalcareous; moderately alkaline; gradual, smooth boundary.

B2t—28 to 39 inches, brown (10YR 5/3) sandy clay loam; dark brown (10YR 4/3) moist; weak, fine and medium, blocky structure; very hard, firm; few fine roots and old root channels; few organic stains on ped faces; few flecks and threads of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—39 to 60 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; few, fine, faint, yellowish-brown mottles; massive; hard, friable; few old worm and termite tunnels partially filled with darker sandy clay loam material; about 15 percent, by volume, weakly to strongly cemented calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from 35 to 60 inches in thickness and is neutral to moderately alkaline in reaction. The A horizon ranges from 10 to 19 inches in thickness and from very dark grayish brown or dark grayish brown to dark gray or very dark gray in color.

The Bt horizon ranges from dark grayish brown or grayish brown to dark brown or brown and is sandy clay loam or clay loam.

The C horizon is pale brown or very pale brown, is calcareous sandy clay loam or clay loam, and ranges from about 5 to 20 percent, by volume, weakly to strongly cemented calcium carbonate concretions.

Ramadero sandy clay loam (Ra).—This soil is in shallow valleys that are mainly parallel and adjacent to small drains. Areas are longer than they are wide, have concave to plane surfaces, and range from 10 to 200 acres in size. Slopes are 0 to 1 percent.

Included with this soil in mapping are soils that are similar to Ramadero soil except they have more clayey or more sandy surfaces. Areas of Caid and Zavco soils are also included. In most places this Ramadero sandy clay loam receives extra water as runoff from surrounding soils. This extra water is beneficial to range, but

where this soil is cultivated, the extra water can damage young crops and impede tillage and harvesting operations.

This soil is well suited to many kinds of crops. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Diversion terraces are useful in places to divert excessive runoff. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, blue panicum, and Kleberg bluestem. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIc-3, dryland, and I-2, irrigated; pasture and hayland group 7C; Ramadero range site.

Randado Series

The Randado series consists of gently sloping, neutral soils on uplands. These shallow soils formed in beds of caliche.

In a representative profile the surface layer is about 5 inches of fine sandy loam that is brown in the upper 2 inches and reddish brown in the lower 3 inches. The next layer is about 12 inches of reddish-brown very friable sandy clay loam that has many indurated caliche fragments in the lower part. The underlying material is white caliche that is indurated in the upper few inches and weakly cemented below.

Randado soils are well drained. Permeability is moderate, and runoff is medium. The available water capacity is low.

These soils are used as range and wildlife habitat.

Representative profile of Randado fine sandy loam, 1 to 3 percent slopes, 9.8 miles south of the courthouse in Uvalde, Tex., on U.S. Highway 83 to county line marker, then 100 feet north and 100 feet west of marker, in range.

A11—0 to 2 inches, brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak, fine, subangular blocky structure and weak, fine, platy; soft, very friable; many fine roots; many fine and medium pores and old root channels; thin crust on surface; neutral; abrupt, smooth boundary.

A12—2 to 5 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, fine and medium, subangular blocky structure; slightly hard, very friable; many fine roots; many fine and medium pores and old root channels; neutral; clear, smooth boundary.

B21t—5 to 14 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist, slightly redder than A12 horizon; weak, fine and medium, subangular blocky structure; slightly hard, very friable; many fine roots; many fine and medium pores and old root channels; a few clay bridges and clay films in pores and root channels; few worm casts and termite tunnels; few hard sandstone fragments 1 to 3 millimeters in size; slightly acid; abrupt, wavy boundary.

B22t—14 to 17 inches, reddish-brown (5YR 4/4) cobbly sandy clay loam, dark reddish brown (5YR 3/4) moist; weak, fine, subangular blocky structure; slightly hard, very friable; an estimated 25 percent broken caliche fragments that are 1/4 to 2 inches thick and 3 to 8 inches wide and are hard and laminar in upper part; a few clay bridges and clay films in pores and root channels and on surface of caliche fragments; noncalcareous; abrupt, wavy boundary.

Ccam—17 to 26 inches, white (10YR 8/2) caliche that is indurated and laminar in the upper part and weakly cemented in the lower part.

The solum ranges from 12 to 20 inches in thickness and from mildly alkaline to slightly acid in reaction. The A horizon ranges from 5 to 10 inches in thickness and from brown or reddish brown to strong brown or yellowish red in color. The Bt horizon, exclusive of coarse fragments, is sandy clay loam or loam. A thin B1t horizon is in some profiles, and the B22t horizon is absent in many profiles. The B2t horizon ranges from 6 to 12 inches in thickness and from reddish brown or yellowish red to red in color. The Ccam horizon is strongly cemented or indurated in the upper 2 to 4 inches.

Randado fine sandy loam, 1 to 3 percent slopes (RdB).—This soil is on uplands, in irregular to subrounded areas that range from about 15 to 100 acres in size.

Included with this soil in mapping are soils that are similar to Randado soil except they have sandstone as the underlying material. Soils that have slopes less than 1 percent, soils that have slopes greater than 3 percent, and small areas of Duval, Hindes, and Yologo soils are also mapped with this soil.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are buffelgrass, blue panicum, and weeping lovegrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are important. Capability unit IVe-2, dryland, and IIe-6, irrigated; pasture and hayland group 14A; Shallow Sandy Loam range site.

Real Series

The Real series consists of gently sloping to steep, very shallow and shallow soils on uplands. These moderately alkaline soils formed in weakly cemented limestone and chalky materials.

In a representative profile, the surface layer is about 13 inches of dark grayish-brown, friable gravelly clay loam that is about 10 percent limestone fragments in the upper 6 inches and about 75 percent fragments in the lower 7 inches. Below this is weakly cemented limestone.

These soils are well drained. Permeability is moderate, and runoff is rapid. The available water capacity is low.

Real soils are used as range and wildlife habitat, and this is their best use. The weakly cemented limestone material underlying these soils is used in road construction and is mined from a few open pits.

Representative profile of Real gravelly clay loam, in an area of Real and Eckrant soils, undulating, about 25 miles north of Uvalde, Tex., on U.S. Highway 83 to metal gate in southwest corner of Garner State Park, then 20 feet east and 50 feet south, in range.

A11—0 to 6 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure parting to moderate, fine, granular; hard, friable; many fine roots; an estimated 10 percent, by volume, weakly cemented limestone fragments 0.2 to 2 inches in diameter and a few cobble and stone size fragments; thin one-fourth inch surface crust that is slightly lighter in color; calcareous; moderately alkaline; abrupt, wavy boundary.

A12—6 to 13 inches, dark grayish-brown (10YR 4/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky

structure parting to moderate, fine, granular; hard, friable; many fine roots; an estimated 75 percent, by volume, weakly cemented limestone fragments 0.2 to 3 inches in diameter; few cobbles and stones; calcareous; moderately alkaline; abrupt, wavy boundary.

R—13 to 36 inches, weakly cemented white limestone in which the upper 1/2 to 1 inch is slightly harder than the material below; thin seams of light yellowish-brown and brownish-yellow material that are more pronounced with increasing depth.

The solum ranges from 8 to 20 inches in thickness and corresponds to the depth to limestone or chalk. The solum is 35 to 85 percent coarse limestone fragments that are mostly from 0.2 to 3 inches in diameter. The A horizon ranges from very dark gray or dark gray to very dark grayish brown, dark grayish brown, dark brown, or brown. This horizon, exclusive of coarse fragments, ranges from loam to clay loam. The underlying limestone or chalk is weakly to moderately cemented. Interbedded strata of hard limestone is in some profiles at depths greater than 12 inches below the upper surface of the limestone.

Real and Eckrant soils, undulating (REB).—This mapping unit is made up of soils on foot slopes that are below the steep limestone hills and above the shallow natural drains in the narrow valleys. A mapped area averages about 42 percent Real soil, 42 percent Eckrant soil, and 16 percent Brackett, Ector, Kavett, Pratley, San Saba, Topia, and Volente soils and Limestone rock land. The percentage of both the Real soil and the Eckrant soil ranges from 0 to 75.

The pattern of each of these soils within delineations is variable, but this variability in composition has been controlled well enough to interpret for the expected use of the soils. Either Real or Eckrant soil is absent in about 25 percent of the mapped areas. Real soil formed in areas of weakly cemented limestone and marl. Eckrant soil formed in areas of indurated limestone.

Mapped areas range from about 100 to more than 500 acres in size, are longer than they are wide, and usually surround the steeper limestone hills. Slopes are mainly 1 to 8 percent.

The Real soil has the profile described as representative of the Real series.

The Eckrant soil has a surface layer of dark-brown clay about 13 inches thick that is about 25 percent limestone fragments in the upper 5 inches and 75 percent in the lower 8 inches. The underlying material is indurated limestone.

Real and Eckrant soils are well drained. Runoff is rapid, and the available water capacity is low. Permeability is moderate on Real soil and moderately slow on Eckrant soil. The hazard of erosion is moderate. Sheet erosion has removed much of the A horizon in many places, and a few rills and shallow gullies have formed in places. Both Real and Eckrant soils are droughty; however, they receive some runoff from the steeper limestone hills.

This mapping unit is used as range and wildlife habitat. Capability unit for Real part VIs-1, dryland, and for Eckrant part VIIs-2, dryland; Real part in Adobe range site and Eckrant part in Low Stony Hill range site.

Rehm Series

The Rehm series consists of undulating, moderately deep to deep, alkaline soils on uplands. These soils formed in gravelly, loamy, and shaly sediments.

In a representative profile the surface layer is about 10 inches of dark grayish-brown gravelly clay loam that is about 20 percent chert pebbles. The upper part of the next layer, extending to a depth of 25 inches, is firm very gravelly clay loam that is about 70 percent chert pebbles and is brown in the upper one-third and light yellowish brown in the lower two-thirds. The lower part, extending to a depth of 42 inches, is very pale brown clay loam that is about 20 percent soft masses and

strongly cemented concretions of lime. The underlying chalky material is intermixed with sandy clay loam and extends to a depth of 66 inches.

Rehm soils are well drained. Permeability is moderate, and runoff is medium. The available water capacity is low. These soils are used as range and wildlife habitat.

Representative profile of Rehm gravelly clay loam, in an area of Rehm soils, undulating, about 3 miles south of Sabinal, Tex., on Farm Road 187, then 1 mile east on a county road, then southeast through gate and 2 miles on private road and 75 feet south of road, in range. Site is 1/4 mile east of hunter's cabin on Rehm Ranch and 250 feet east of an unnamed creek.

A1—0 to 10 inches, dark grayish-brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky and granular structure; hard, firm; common fine roots; few old root channels and fine pores; an estimated 20 percent, by volume, chert pebbles mainly 1 to 2 inches in diameter, few cobbles; few films and threads of segregated calcium carbonate; thin soft surface crust that is lighter in color; calcareous; moderately alkaline; clear, smooth boundary.

B21—10 to 15 inches, brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 4/3) moist; moderate, fine, subangular blocky structure; very hard, firm; common fine roots; few old root channels and fine pores; an estimated 70 percent, by volume, chert pebbles, few cobbles, and part of these pebbles and cobbles have very thin calcium carbonate coatings, especially on lower sides; few films and threads of segregated calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

B22ca—15 to 25 inches, light yellowish-brown (10YR 6/4) very gravelly clay loam, yellowish brown (10YR 5/4) moist; weak, fine, subangular blocky structure; hard, firm; an estimated 70 percent, by volume, chert pebbles, few cobbles, and part of these pebbles and cobbles have very thick calcium carbonate coatings, especially on lower sides; an estimated 5 percent soft masses, films, and threads of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

B3ca—25 to 42 inches, very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, firm; an estimated 20 percent soft masses and strongly cemented concretions of calcium carbonate up to 1/2 inch in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

C—42 to 66 inches, about equal parts of brownish-yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist, and white (2.5Y 8/2) dry chalky material, thin streaks of light yellowish brown, light olive brown, and strong brown; massive; calcareous; moderately alkaline.

The solum ranges from 30 to 60 inches in thickness. Layers that are high in calcium carbonate are at depths ranging from 22 to 40 inches. The A horizon ranges from very dark grayish brown or dark grayish brown to grayish brown or brown. This horizon is from 20 to 50 percent coarse fragments and, exclusive of coarse fragments, ranges from loam to clay loam.

The B horizon is 35 to 80 percent, by volume, coarse fragments, mainly rounded chert. This horizon, exclusive of coarse fragments, ranges from loam to clay loam. The B2 horizon ranges from grayish brown or brown to light yellowish brown. The B3ca horizon is not in some profiles. The C horizon ranges from sandy clay loam and chalk mixture to shaly clay containing some gypsum crystals.

Rehm soils, undulating (RhB).—This mapping unit is made up of soils in upland areas that are long, narrow, and parallel to small drains. Areas are mainly about 40 to 80 acres in size but range from 20 to 200 acres. Slopes are usually 1 to 3 percent but

range up to 8 percent. This unit consists of about 55 percent Rehm soils, 10 percent of a soil that is similar to Rehm except it has a lighter-colored surface layer, 15 percent of a soil that is similar to Rehm soils except it has a very gravelly surface layer and only a few pebbles below the surface, and 20 percent other soils. The soils in this unit are not in regular patterns.

Included in mapping are small areas of Dant, Olmos, and Uvalde soils. The hazard of erosion on this mapping unit is moderate. Capability unit VIs-2, dryland; Shallow range site of the Rio Grande Plain.

Rock land

Rock land consists of limestone bedrock that is mainly in bands that are a few feet to several hundred feet wide. The exposed bedrock makes up 70 to 90 percent of this unit. Small areas of very shallow soils covered with limestone pebbles, cobbles, stones, and boulders are between the bedrock exposures.

Rock land-Real association, steep (RRE).—This mapping unit is made up of an average of 36 percent Rock land, 33 percent Real soils, and 31 percent other soils. The percentage of Rock land ranges from 30 to 40 and that of Real soils from 20 to 45. The composition of this unit is more variable than that of most other units in the county but has been controlled well enough to interpret for the expected use of the soils.

Areas range from about 200 acres on a few isolated hills to more than 10,000 acres in size. Slopes are mainly 30 to 45 percent, but some slopes are 5 to 30 percent, and some are 45 to 65 percent. Exposures of limestone bedrock on the upper slopes of many of the hills are almost vertical.

Rock land consists of exposed indurated limestone bedrock that is mainly in bands that are a few feet to several hundred feet wide. Rock land is on 67 percent of the upper slopes and narrow caps of the hills. In places a 1 to 2 inch mantle of dark soil material overlies the bedrock.

Real soils are on 75 percent of the lower slopes of the hills. These soils formed mostly over materials weathered from soft limestone, marl, and seams of shale or hard limestone of the Glen Rose Formation.

In a representative profile of the Real soils, the surface layer is about 12 inches thick. It is dark grayish-brown, friable, gravelly clay loam. It is about 20 percent limestone fragments in the upper 5 inches and 70 percent in the lower 7 inches. The underlying material is weakly cemented limestone.

Included in this mapping unit are small areas between the Rock land outcrops that are mainly Eckrant soils. Brackett soils are on the steeper slopes. Dev, Kavett, Orif, Pratley, Speck, and Topia soils are in the narrow valleys.

Rock land sheds almost all rainfall to surrounding soils, and this runoff greatly improves the moisture conditions of these soils.

Real soils are well drained. Permeability is moderate, and runoff is rapid. The available water capacity is low. These soils receive runoff from the higher Rock land. Sheet erosion is active, and the hazard of erosion is moderate. Differences in erosion patterns are caused by the speed of runoff. The speed is least on the upper slopes, increases on the lower slopes, and is greatest on the foot slopes where the most sheet and some rill and gully erosion occur. Soil materials washed from upper slopes offset some of the losses from erosion.

This mapping unit is used as range and wildlife habitat. Sheep and goats mostly use this unit because the slopes are too steep for cattle. Some wildlife is in the canyons where cover is more abundant.

Vegetative cover is more dense on the northern slopes of steep hills because these slopes are cooler and evaporation is less. In many places on these slopes, the dense overstory of woody plants shades the soil so well that very little grass grows. A

less dense overstory of woody plants and more grass grows on the warmer, less moist, southern slopes. Sheep and goats seem to prefer these southern or near-southern exposures, and they are mostly overgrazed. Capability unit for Rock land part VIIIs-2, dryland, and for Real Part VIIs-2, dryland; Rock land part in Steep Rocky range site and Real part in Steep Adobe range site.

Sabenyo Series

The Sabenyo series consists of gently sloping soils on uplands. These calcareous soils formed in loamy materials.

In a representative profile the surface is brown friable clay loam about 11 inches thick. The next layer is about 44 inches of friable clay loam. It is light brown in the upper 6 inches and is about 5 percent weakly cemented concretions of lime. It is reddish yellow in the lower 38 inches and is about 30 percent weakly cemented lime concretions in the upper part and 25 percent in the lower part. The underlying material is pink sandy loam that reaches to a depth of 85 inches.

Sabenyo soils are well drained. Permeability is moderate, and runoff is medium. The available water capacity is moderate. These soils are used mainly for crops.

Representative profile of Sabenyo clay loam, 1 to 5 percent slopes, 7.3 miles south on Farm Road 187 from its intersection with U.S. Highway 90 in Sabinal, Tex., then 200 feet east from right-of-way in a cultivated field and 100 feet south of cross fence.

Ap—0 to 5 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak, fine and medium, subangular blocky structure; slightly hard, friable; few fine roots; few fine pores and old root channels; few strongly cemented calcium carbon-ate concretions up to 1/4 inch in diameter; 40 percent calcium carbonate; few snail shell fragments on surface; 1/4 inch crust on surface that has platy structure and is slightly lighter in color; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—5 to 11 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak, fine and medium, subangular blocky structure; hard, friable; few fine roots; few fine pores and old root channels; few weakly cemented calcium carbonate concretions up to 1/4 inch in diameter; few snail shell fragments; calcareous; moderately alkaline; abrupt, smooth boundary.

B21—11 to 17 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate, fine and medium, subangular blocky structure; hard, friable; many fine pores and old root channels; many threads of segregated calcium carbonate; an estimated 5 percent, by volume, weakly cemented calcium carbonate concretions up to 1/2 inch in diameter; 40 percent calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B22ca—17 to 34 inches, reddish-yellow (7.5YR 7/6) clay loam, reddish yellow (7.5YR 7/6) moist; weak, fine and medium, subangular blocky structure; hard friable; few fine and medium pores; an estimated 30 percent, by volume, weakly cemented concretions of calcium carbonate up to 1 inch in diameter; 50 percent calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B23ca—34 to 55 inches, reddish-yellow (7.5YR 7/6) clay loam, reddish yellow (7.5YR 7/6) moist; weak, fine, subangular blocky structure; hard, friable; an estimated 25 percent, by volume, pinkish-white (7.5YR 8/2) strongly cemented concretions of calcium carbonate up to 2 inches in diameter; 50 percent calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—55 to 85 inches, pink (7.5YR 8/4) sandy loam, pink (7.5YR 7/4) moist; massive; friable, slightly hard; 50 percent calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to 70 inches in thickness. The depth to horizons that are more than 40 percent calcium carbonate ranges from 12 to 20 inches. An estimated 1/3 to 1/2 of the clay fraction is carbonates. The A horizon ranges from 4 to 14 inches in thickness and is brown, pale brown, or very pale brown in color. The B horizon is brown, pale brown, very pale brown, light brown, light yellowish brown, reddish yellow, or pink. This horizon is loam or clay loam. The B2ca horizon is from about 15 to 30 percent visible masses and concretions of calcium carbonate. The C horizon is brown, pale brown, very pale brown, light brown, light yellowish brown, reddish yellow, or pink.

Sabenyo clay loam, 1 to 5 percent slopes (SaC).—This soil is in long, narrow areas on uplands between the slightly higher Knippa or Uvalde soils and the slightly lower Atco, Conalb, or Frio soils. Areas range from about 25 to 250 acres in size.

Included with this soil in mapping are less extensive areas of Knippa and Uvalde soils and eroded spots.

This Sabenyo clay loam is subject to a moderate hazard of erosion. The high lime content of this soil causes chlorosis of some plants.

This soil is used mainly for crops or for pasture and hay. Small grain and grain sorghum are the dominant crops. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are Kleberg bluestem, blue panicum, and buffelgrass.

Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IVe-3, dryland, and IIe-7, irrigated; pasture and hayland group 13A; Shallow range site of the Rio Grande Plain.

San Saba Series

The San Saba series consists of nearly level, moderately deep, mildly alkaline soils on uplands. These soils formed in shallow valleys that are underlain by limestone.

In a representative profile stones cover about 15 percent of the surface. The surface layer is 29 inches of very dark gray very firm clay that has few limestone fragments. Below this is indurated limestone bedrock.

San Saba soils are moderately well drained. Permeability is very slow, and runoff is slow. The available water capacity is high. When these soils are dry, cracks form on the surface that are about 1/2 to 2 inches wide and penetrate more than 2 feet into the soil. Water enters the soil readily when these cracks are open, but after the soil becomes wet and the cracks close, water enters very slowly.

San Saba soils are used mostly as range and wildlife habitat. A few, small, isolated fields are cultivated mainly to small grain or grain sorghum.

Representative profile of San Saba stony clay, 10.3 miles north on U.S. Highway 83 from the courthouse in Uvalde, Tex., then 780 feet east of highway right-of-way, in range.

A11—0 to 8 inches, very dark gray (10YR 3/1) stony clay, black (10YR 2/1) moist; moderate, fine, blocky structure; extremely hard, very firm, very sticky

and very plastic; common fine roots; few limestone fragments; 15 percent stones, cobbles, and pebbles of limestone on surface; mildly alkaline; gradual, wavy boundary.

A12—8 to 20 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, fine and medium, blocky structure; extremely hard, very firm, very sticky and very plastic; common fine roots; few limestone fragments; intersecting slickensides; peds have shiny surfaces; mildly alkaline; clear, wavy boundary.

A13—20 to 29 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, fine and medium, blocky structure; extremely hard, very firm, very sticky and very plastic; common fine roots; few limestone fragments; intersecting slickensides that part to parallelepipeds; peds have shiny surfaces; calcareous; moderately alkaline to alkaline; abrupt, wavy boundary.

R—29 to 30 inches, indurated limestone bedrock.

This soil ranges from 24 to 40 inches deep to limestone. When this soil is dry, cracks that are 1/2 to 2 inches wide and as deep as 20 inches or more form on the surface. These cracks open and close more than once during the year. Where this soil has not been plowed, the gilgai micro-relief consists of microlows that are 3 to 8 inches lower than the microhighs. The microlows are 5 to 12 feet across and the linear distance between their centers is 10 to 20 feet. This gilgai relief is more prominent in some areas than in others. The soil is moderately to mildly alkaline in reaction. The surface is covered by coarse limestone fragments that range from a few scattered fragments to as much as 20 percent cobbles, stones, and boulders.

The upper part of the A horizon is very dark gray or gray. The lower part ranges from very dark gray to grayish brown. A Ca horizon that is 2 to 5 inches thick and has calcium carbonate-coated limestone fragments is in some profiles.

San Saba clay (Sb).—This nearly level soil is in shallow valleys that are between the steeper limestone hills. Most areas are longer than they are wide and range from 5 to 100 acres in size, but they are mainly 15 to 50 acres in size. Slopes are commonly less than 1 percent but range from 0 to 2 percent.

In a representative profile the surface layer is very dark gray very firm clay in the upper 15 inches, very dark grayish-brown very firm clay in the next 7 inches, and dark grayish-brown clay in the lower 4 inches. Below this is indurated limestone bedrock.

Included with this soil in mapping are areas of similar soils except they are either deeper or more shallow than San Saba clay. Pratley, Tobosa, and Topia soils and small stony areas also are included.

This soil is subject to a slight hazard of erosion. Small grain and grain sorghum are the main crops. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. If the soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are kleingrass, King Ranch bluestem, and Kleberg bluestem. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIc-3, dryland, and IIs-3, irrigated; pasture and hayland group 7A; Deep Upland range site.

San Saba stony clay (Sc).—This nearly level soil is in shallow valleys that are between the steeper limestone hills. Most areas are longer than they are wide and

are mainly 15 to 50 acres in size, but they range from 5 to 100 acres. Slopes are commonly less than 1 percent but range from 0 to 2 percent.

This soil has the profile described as representative of the San Saba series.

Included with this soil in mapping are soils that are similar to San Saba except they have either more or less soil depth. Tobosa soil and areas without a stony surface are also included.

This San Saba stony clay is subject to a slight hazard of erosion. The stony surface makes tillage impractical. This soil is used as range and wildlife habitat. Capability unit VIs-4, dryland; Deep Upland range site.

Speck Series

The Speck series consists of undulating, shallow, neutral soils on uplands. These soils formed in materials weathered from indurated limestone.

In a representative profile the surface layer is very dark grayish brown very firm clay about 8 inches thick. The next layer is about 9 inches of reddish-brown very firm clay. Light-gray to white limestone bedrock is at a depth of 17 inches. Many stones are on the surface, and a few limestone and chert fragments are in the soil mass.

Speck soils are well drained. Permeability is slow, and runoff is medium. The available water capacity is low. These soils are used as range or wildlife habitat.

Representative profile of Speck clay, in an area of Speck soils, undulating, 18.7 miles north on U.S. Highway 83 from its junction with Texas Highway 55 at the northern edge of Uvalde, Tex., then 0.7 mile northwest on Ranch Road 1051, then 3.1 miles southwest on a small private ranch road (this point is 380 feet northeast of corral), then 50 feet west, in range.

A1—0 to 8 inches, very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky structure parting to moderate, very fine, blocky; very hard, very firm, very sticky and very plastic; many fine roots; few small pockets of dark reddish-brown (5YR 3/3) moist clay; an estimated 10 percent, by volume, limestone and chert fragments; stone-size fragments on the surface range from 1 to 5 feet in diameter and are at intervals of 3 to 30 feet apart; neutral; clear, smooth boundary.

B2t—8 to 17 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate, medium, blocky structure parting to moderate, fine, blocky; extremely hard, very firm, very sticky and very plastic; many fine roots; clay films on ped faces; an estimated 15 percent, by volume, limestone and chert fragments; slightly acid; abrupt, wavy boundary.

R—17 to 18 inches, light-gray to white limestone bedrock; fractured; calcareous.

The solum ranges from 14 to 20 inches in thickness to limestone bedrock or limestone conglomerate. It is from mildly alkaline to slightly acid in reaction. On the surface and in the soil are coarse fragments that range from a few to as much as 25 percent. The cobbles and stones are mostly limestone, and the pebbles are mostly angular chert.

The A horizon ranges from very dark grayish brown to brown or reddish brown and from clay to clay loam. Secondary lime is in the Bt horizon as soft concretions above the limestone or as coatings on the surface of fragments and in fractures. The B2t horizon ranges from reddish brown or dark reddish brown to brown. The coarse fragments are mainly in the B2t horizon.

Speck soils, undulating (SpB).—This mapping unit consists of soils on uplands. These soils are mainly between the steeper limestone hills and the drainage ways. This unit consists of about 55 percent Speck soils, 30 percent soils that are similar to Speck except they have either a thin indurated caliche layer above the limestone or

20 to 40 inches of soils over the limestone, and 15 percent soils that are similar to Speck except they are very gravelly. The soils in this unit are not in regular patterns.

Mapped areas are irregular and range from about 30 to 300 acres in size, but they are mostly about 75 to 150 acres in size. Slopes are mainly 1 to 3 percent but range from 1 to about 7 percent.

Included in some mapped areas are Eckrant, Kavett, and San Saba soils.

This mapping unit is subject to a moderate hazard of erosion. The stony surface helps to reduce erosion, increase water intake, and reduce evaporation. Capability unit Vls-3, dryland; Redland range site.

Tobosa Series

The Tobosa series consists of nearly level to gently sloping, deep, calcareous soils on uplands. These soils formed in calcareous clays in valleys or on old terraces that are below the steeper limestone hills.

In a representative profile, the surface layer is dark grayish-brown very firm clay about 30 inches thick. The next layer is about 16 inches of grayish-brown very firm clay. The underlying material is brown clay that reaches to a depth of about 56 inches, is about 40 percent limestone fragments that are partly lime coated, and has a few small lime concretions.

Tobosa soils are moderately well drained. Permeability is very slow, and runoff is slow to medium. The available water capacity is high. When these soils are dry, cracks about 1/2 to 2 inches wide form on the surface and penetrate several feet into the soil. Water enters the soil readily when the cracks are open, but after the soil becomes wet and the cracks close, water enters very slowly. Scattered small depressions are on the surface in areas that have never been plowed.

Tobosa soils are used mainly as range and wildlife habitat. A few small areas are dryfarmed and irrigated.

Representative profile of Tobosa clay, 0 to 1 percent slopes, 7.7 miles north of Uvalde, Tex., by U.S. Highway 83, then 1.8 miles east and northeast on Farm Road 2690, then 1.2 miles north on a road to ranch house, then 0.4 mile west of house, in range.

A11—0 to 12 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure parting to weak, fine, blocky; extremely hard, very firm, very sticky and very plastic; many fine roots; few limestone fragments on surface and in soil mass; calcareous; moderately alkaline; gradual, smooth boundary.

A12—12 to 30 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate, medium and coarse, blocky structure; extremely hard, very firm, very sticky and very plastic; many fine roots; few fine limestone fragments; intersecting slickensides; many peds that have shiny faces; calcareous; moderately alkaline; gradual, smooth boundary.

AC—30 to 46 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate, medium, blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few limestone fragments; few fine brown mottles; intersecting slickensides; few tongues of darker clay; calcareous; moderately alkaline; abrupt, smooth boundary.

C—46 to 56 inches, brown (10YR 5/3) gravelly clay, dark brown (10YR 4/3) moist; massive; very hard, very firm; few fine distinct mottles of grayish brown and light brown; an estimated 40 percent limestone fragments that are partly calcium carbonate coated; few small calcium carbonate concretions; few tongues of darker clay; calcareous; moderately alkaline.

The solum ranges from 41 to 60 inches in thickness. When the soil is dry, surface cracks are weakly to strongly expressed; they are as wide as one-half inch to 2 inches and penetrate to depths below 20 inches. Where this soil has not been plowed, the gilgai microrelief ranges from very indistinct to moderately distinct. Where the gilgai microrelief is distinct, the microdepressions are 4 to 10 inches in depth, 5 to 8 feet wide, and 10 to 20 feet between centers.

The A horizon ranges from brown or dark brown to dark grayish brown. The All horizon ranges from 12 to 32 inches in thickness. The AC horizon ranges from 12 to 29 inches in thickness and from grayish brown or pale brown to brown in color. The C horizon has visible calcium carbonate that ranges from none to about 10 percent. An R layer of hard limestone is in some profiles where this soil is associated with areas of limestone soils.

These soils in the southern part of the county are outside the range of the Tobosa series in that the mean annual soil temperature is slightly more than 72° F. This difference does not affect use and management.

Tobosa clay, 0 to 1 percent slopes (ToA).—This nearly level soil is on uplands, mainly in irregular and subrounded areas from 25 to 100 acres in size.

This soil has the profile described as representative of the Tobosa series.

Included with this soil in mapping are narrow areas mainly next to small drains that have slopes greater than 1 percent. Areas of Knippa, Montell, San Saba, and Uvalde soils, small gravelly areas, and areas of a soil that is similar to Tobosa except it is lighter in color also are included in mapping.

Runoff is slow, and the hazard of erosion is slight.

This Tobosa clay is suited to small grains, grain sorghum, and introduced grasses where dryfarmed. These same crops and many kinds of truck crops can be irrigated.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. If the soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are johnsongrass, kleingrass, King Ranch bluestem, and Kleberg bluestem. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IVs-1, dryland, and IIs-3, irrigated; pasture and hayland group 7A; Deep Upland range site.

Tobosa clay, 1 to 3 percent slopes (ToB).—This gently sloping soil is on uplands. Soil areas are irregular and about 15 to 75 acres in size.

In a representative profile of this soil, the surface layer is dark grayish-brown clay in the upper 8 inches and dark-brown very firm clay in the lower 10 inches. The next layer is about 20 inches of brown very firm clay. The underlying material is pale-brown clay that reaches to a depth of 50 inches and contains a few limestone fragments and a few lime concretions.

Included with this soil in mapping are small areas of Tobosa soils that have slopes of less than 1 percent and some that have slopes of 3 to 5 percent. Areas of Knippa, Montell, San Saba, and Uvalde soils, gravelly areas, and areas of a soil that is similar to Tobosa soil except it is lighter in color also are included in mapping.

Runoff is medium, and the hazard of erosion is moderate. A small acreage of this Tobosa clay is cultivated. This soil is suited to small grain, grain sorghum, and introduced grasses where dryfarmed. These same crops and many kinds of truck crops can be irrigated.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. If

the soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are johnsongrass, kleingrass, King Ranch bluestem, and Kleberg bluestem. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IVe-1, dryland, and IIIe-2, irrigated; pasture and hayland group 7A; Deep Upland range site.

Topia Series

The Topia series consists of nearly level to gently sloping, moderately deep, neutral soils on uplands. These soils formed in clayey materials weathered from limestone, either in valleys or on bench positions below the steeper limestone hills.

In a representative profile, the surface layer is about 7 inches of very dark gray firm clay. The next layer is clay that extends to a depth of 30 inches and is very firm and dark reddish brown in the upper 15 inches. In the lower 8 inches, it is reddish brown, very firm, and has a few weakly cemented limestone fragments in the upper part, and it is firm and has about 50 percent weakly cemented limestone fragments in the lower part. Below this, extending to a depth of 48 inches, is very pale brown and yellow, weakly consolidated limestone.

Topia soils are well drained. Permeability is very slow, and runoff is slow to medium. The available water capacity is high. These soils crack when they are dry. Water then enters the soil readily, but after it becomes. wet and the cracks close, the water enters very slowly. These soils are used mainly as range and wildlife habitat. A few scattered areas are cultivated.

Representative profile of Topia clay, 0 to 3 percent slopes, 1.4 miles west of Utopia, Tex., on Farm Road 1050, then 0.75 mile south and west on a county road and 400 feet south, in range.

A1—0 to 7 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine and medium, subangular blocky and granular structure; very hard, firm, very sticky and plastic; many fine roots; few fine pores and old root channels; neutral; clear, smooth boundary.

B21t—7 to 12 inches, dark reddish-brown (5YR 3/2) clay; dark reddish brown (5YR 2/2) moist; moderate, fine and very fine, blocky structure; extremely hard, very firm, very sticky and plastic; many fine roots; clay films on peds; dark organic staining on few peds; few cracks partially filled with soil from above; few pockets of redder clay; neutral; gradual, wavy boundary.

B22t—12 to 22 inches, dark reddish-brown (5YR 3/3) clay, dark reddish brown (5YR 3/3) moist; moderate, medium and fine, blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; clay films on peds; distinct shiny pressure faces; dark organic staining on few peds; few vertical tongues, 1 inch wide, of darker clay; few pockets of red clay; few fine limestone fragments; neutral; gradual, wavy boundary.

B23t—22 to 27 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; weak, fine and medium, blocky structure; very hard, very firm, sticky and plastic; few fine roots; few thin clay films on peds; few distinct pressure faces; dark organic staining on few peds; few vertical streaks or tongues of darker clay; estimated 2 percent, by volume, weakly cemented limestone fragments 1 to 2 millimeters in size; few larger fragments; calcareous; moderately alkaline; clear, wavy boundary.

B24t—27 to 30 inches, reddish-brown (5YR 4/4) very gravelly clay, dark reddish brown (5YR 3/4) moist; weak, fine and medium, subangular blocky

structure; very hard, firm; few fine roots; estimated 50 percent, by volume, weakly cemented limestone fragments; many of the fragments are coated with clay; calcareous; moderately alkaline; abrupt, wavy boundary.

R—30 to 48 inches, very pale brown (10YR 7/4) and yellow (10YR 7/6) weakly consolidated limestone; streaks and splotches of reddish yellow (7.5YR 6/6 and 5YR 6/6); upper one-half inch is slightly harder than limestone below.

The solum ranges from 21 to 40 inches in thickness and corresponds to the depth to limestone. When the soil is dry, cracks form that are up to 2 inches wide at the surface, extend to a depth of 20 inches or more, and are 1/4 to 1/2 inch wide at a depth of 20 inches. The A horizon is from a few to as much as 15 percent fine limestone and chert fragments. The A1 horizon ranges from 4 to 10 inches in thickness, from very dark gray or very dark grayish brown to brown, dark brown, or dark reddish brown in color, and from mildly alkaline through slightly acid in reaction.

The upper 20 inches of the Bt horizon ranges from a few to as much as 15 percent, by volume, coarse fragments. In the lower part of the Bt horizon, the secondary carbonates range from very thin coatings on the limestone to 10 percent, by volume. The B21t horizon ranges from 5 to 17 inches in thickness, from brown or dark brown to dark reddish gray, dark reddish brown, or reddish brown in color, and from mildly alkaline through slightly acid in reaction. The B21t horizon is from a few to as much as 15 percent fine limestone and chert fragments. The B22t horizon ranges from 3 to 13 inches in thickness, from dark reddish brown or reddish brown to dark brown in color, and from mildly alkaline through slightly acid in reaction. The B22t horizon is from a few to as much as 15 percent fine limestone and chert fragments. The B23t and B24t horizons are mildly or moderately alkaline in reaction and from a few to as much as 60 percent fine limestone and chert fragments. A few profiles do not have the B23t and B24t horizons. The R layer is interbedded chalk, marl, weakly consolidated limestone, and indurated limestone.

Topia clay, 0 to 3 percent slopes (TpB).—This soil is on uplands in areas that are mainly irregular and about 20 to 100 acres in size. Slopes are commonly 0.5 to 2 percent.

Included with this soil in mapping are areas of a soil that is similar to Topia except it is more than 40 inches deep to limestone, is underlain by indurated limestone, is very gravelly, or is lighter in color. Less extensive areas of Kavett, Pratley, San Saba, and Speck soils also are included in mapping.

Small grain and grain sorghum are the main cultivated crops. A good cropping system for cultivated areas utilizes crops that will protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. If the soil is irrigated, a well-designed irrigation system and proper water management are needed.

The main adapted plants used for pasture and hay are improved bermudagrass, King Ranch bluestem, and kleingrass. Among the management needs of pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIe-7, dryland, and IIIe-2, irrigated; pasture and hayland group 7A; Redland range site.

Uvalde Series

The Uvalde series consists of nearly level to gently sloping, deep, calcareous soils on stream terraces and alluvial fans. These soils formed in calcareous sediments washed from limestone areas.

In a representative profile, the surface layer is about 16 inches of dark-brown friable silty clay loam. The next layer is friable silty clay loam about 36 inches thick. It

is brown and has a few films and threads of lime in the upper part, and it is very pale brown and is about 30 percent weakly to strongly cemented concretions of lime in the lower part. The underlying material is very pale brown friable silty clay loam that reaches to a depth of 80 inches and is about 15 percent weakly cemented concretions and soft masses of lime.

Uvalde soils are well drained. Permeability is moderate, and runoff is slow. The available water capacity is high.

Uvalde soils are used mainly as range and wildlife habitat, but a large acreage is cultivated. Small grain and grain sorghums are the main crops dryfarmed. These same crops and cotton, corn, and many kinds of truck crops are irrigated.

Representative profile of Uvalde silty clay loam, 0 to 1 percent slopes, 1.5 miles west of the courthouse in Uvalde, Tex., on U.S. Highway 90, then 9.3 miles southwest on Farm Road 481 (this point is 1 mile west of Nueces River), then 175 feet south of property fence, in range.

A1—0 to 16 inches, dark-brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate, very fine, subangular blocky and granular structure; hard, friable; many fine roots; many fine pores and old root channels; common worm casts; one-half inch crust on surface that is slightly lighter in color; few fine snail shell fragments; calcareous; moderately alkaline; gradual, smooth boundary.

B21—16 to 35 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate, medium and fine, subangular blocky structure; hard, friable; common fine roots; common fine pores; few films and threads of segregated calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B22ca—35 to 52 inches, very pale brown (10YR 7/3) silty clay loam, yellowish brown (10YR 5/4) moist; moderate, fine and medium, subangular blocky structure; hard, friable; few fine roots; an estimated 30 percent, by volume, segregated and weakly to strongly cemented concretions of calcium carbonate up to one-fourth inch in diameter; calcareous; moderately alkaline; diffuse, wavy boundary.

Cca—52 to 80 inches, very pale brown (10YR 7/4) silty clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable; an estimated 15 percent, by volume, weakly cemented concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. In places, scattered water-rounded limestone gravels are on the surface, and a few are in the soil mass. In some profiles a gravelly stratum is below a depth of 48 inches. The conductivity at 25° C of the saturation extract from material below the 36-inch depth ranges from 0.9 to 2.0 millimhos.

The A horizon ranges from 10 to 20 inches in thickness and from dark grayish brown to dark brown or brown in color. The B horizon ranges from 16 to 40 inches in thickness, from brown, pale brown, or very pale brown to light brown or light yellowish brown in color, and from clay loam or silty clay loam to clay or silty clay in texture. The lower part of the B and the C horizons is about 15 to 40 percent visible calcium carbonate as soft masses and concretions. Total calcium in these horizons ranges from 40 to 75 percent.

Uvalde silty clay loam, 0 to 1 percent slopes (UvA).—This nearly level soil is on stream terraces or alluvial fans. Soil areas are mainly long and broad and range from about 20 to more than 500 acres in size. Slopes are mostly less than 0.5 percent.

This soil has the profile described as representative of the Uvalde series.

Included with this soil in mapping are a few areas of Atco, Castroville, Knippa, and Olmos soils.

Runoff is slow, and the hazard of erosion is slight.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, blue panicum, and buffelgrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIc-2, dryland, and I-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

Uvalde silty clay loam, 1 to 3 percent slopes (UvB).—This gently sloping soil is on the breaks to small drains or on the breaks between nearly level soils on uplands and soils on lower terraces, or alluvial soils. Most areas are long and narrow and parallel to the streams and are commonly less than 50 acres in size.

In a representative profile of this soil, the surface layer is grayish-brown friable silty clay loam about 12 inches thick. The next layer is about 20 inches of pale-brown friable clay. The next layer extends to a depth of 60 inches and is very pale brown clay that is about 25 percent weakly cemented concretions and soft masses of lime.

Included with this soil in mapping are areas that have slopes less than 1 percent and areas of Atco, Castroville, and Sabenyo soils.

Runoff is slow, and the hazard of erosion is moderate.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnish sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, King Ranch bluestem, Kleberg bluestem, blue panicum, and buffelgrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIe-2, dryland, and IIe-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

Valco Series

The Valco series consists of nearly level to gently sloping, shallow, calcareous soils on uplands. These soils formed in calcareous sediments that overlay caliche.

In a representative profile, the surface layer is friable clay loam about 17 inches thick. It is grayish brown in the upper part, and it is brown and has a few strongly cemented concretions of lime and a few limestone fragments in the lower part. Many strongly cemented caliche fragments are in the lower 2 inches. The underlying material reaches to a depth of 36 inches and is caliche that is strongly cemented in the upper 2 inches and weakly cemented below.

Valco soils are well drained. Permeability is moderate, and runoff is slow to medium. The available water capacity is low.

These soils are used mainly as range and wildlife habitat. A few small areas are cultivated. Small grain and grain sorghums are the main dryland crops. These same crops, and cotton, corn, and many kinds of truck crops are irrigated.

Representative profile of Valco clay loam, 0 to 3 percent slopes, 6.5 miles south of the courthouse in Uvalde, Tex., on U.S. Highway 83, then 850 feet east from metal gate along ranch road and 140 feet south, in range.

A11—0 to 7 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine and medium, subangular blocky and fine granular structure; hard, friable; many fine roots and root channels; few worm casts and termite tunnels; few threads and few hard calcium carbonate concretions up to 3 millimeters in diameter; few small angular limestone fragments up to 1 inch in diameter; one-fourth inch crust on surface that is light gray (10YR 7/2); calcareous; moderately alkaline; clear, smooth boundary.

A12—7 to 15 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak, fine and medium, subangular blocky structure; hard, friable; many fine roots; few fine pores and old root channels; few threads and few strongly cemented calcium carbonate concretions up to 5 millimeters in diameter; few, small, angular limestone fragments; calcareous; moderately alkaline; clear, smooth boundary.

A13—15 to 17 inches, brown (10YR 5/3) very gravelly clay loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; hard, friable; many fine roots; few fine pores; an estimated 60 percent, by volume, strongly cemented caliche fragments, mainly 1/2 to 2 inches in diameter; calcareous; moderately alkaline; abrupt, smooth boundary.

C1cam—17 to 19 inches, very pale brown (10YR 7/3) to white (10YR 8/2), strongly cemented caliche that is weakly laminar in the upper part; a few old solution channels partially filled with soil material like that of the horizon above; calcareous; abrupt, smooth boundary.

C2ca—19 to 36 inches, very pale brown (10YR 7/3) to white (10YR 8/2), weakly cemented caliche; a few rounded limestone pebbles.

The solum to a cemented caliche layer ranges from 13 to 20 inches in thickness. In the upper part, the solum ranges from a few to about 20 percent coarse fragments, and in the lower 2 to 5 inches, it ranges from a few to as much as 80 percent coarse fragments. The A horizon ranges from very dark grayish brown to grayish brown, dark brown, and brown. The A13 horizon is not in many profiles. The strongly cemented caliche in the C1cam horizon ranges from about 1 inch to as much as 7 inches in thickness. The C2ca horizon ranges from weakly cemented caliche to pinkish limy earth of about clay loam texture.

Valco clay loam, 0 to 3 percent slopes (VaB).—Areas of this soil are varied in shape but are most commonly long and narrow and range from about 5 to 150 acres in size.

Included with this soil in mapping are areas that are similar to this Valco soil except they have gravelly surfaces, are more clayey, or are underlain with soft caliche. Also included are areas of Knippa, Olmos, Uvalde, and Zapata soils.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are Kleberg bluestem, blue panicum, and buffelgrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IVs-2, dryland, and IIIe-1, irrigated; pasture and hayland group 13A; Shallow range site of the Rio Grande Plain.

Volente Series

The Volente series consists of nearly level to gently sloping, deep, calcareous soils in valleys. These soils formed in calcareous sediments washed from nearby limestone hills.

In a representative profile, the surface layer is dark grayish-brown clay loam about 12 inches thick. The next layer is about 23 inches of brown firm clay that contains a few strongly cemented lime concretions in the lower part. The underlying material is very pale brown clay that reaches to a depth of 60 inches and is 5 to 10 percent strongly cemented concretions and soft masses of lime.

Volente soils are well drained. Permeability is moderately slow, and runoff is slow to medium. The available water capacity is high.

These soils are used mostly as range and wildlife habitat. On those areas that are cultivated, small grain and grain sorghums are the main crops.

Representative profile of Volente clay loam, 0 to 1 percent slopes, 15 miles north on Farm Road 187 from its intersection with U.S. Highway 90 in Sabinal, Tex., then 0.45 mile west on a private road, then 100 feet north, in a field.

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, subangular blocky structure; very hard, firm; few fine roots; few fine pores and old root channels; few limestone fragments 1 to 2 millimeters in size; calcareous; moderately alkaline; abrupt, smooth boundary.

A11—6 to 12 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure parting to moderate, very fine, blocky; very hard, firm; few fine roots and old root channels; few worm casts; peds have slightly shiny surfaces; few limestone pebbles; calcareous; moderately alkaline; clear, smooth boundary.

A12—12 to 24 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, fine and very fine, blocky structure; very hard, firm; few fine roots; peds have shiny surfaces; few hard limestone fragments 1 to 2 millimeters in size; few narrow tunnels filled with darker soil; calcareous; moderately alkaline; gradual, smooth boundary.

B2—24 to 35 inches, brown (7.5YR 4/4) clay, dark brown (7.5YR 3/4) moist; moderate, fine and very fine, blocky structure; very hard, firm; few fine roots; few organic stains on peds; an estimated 2 or 3 percent, by volume, strongly cemented calcium carbonate concretions and small limestone fragments that are calcium carbonate coated; calcareous; moderately alkaline; clear, smooth boundary.

C1ca—35 to 52 inches, very pale brown (10YR 7/4) clay, light yellowish brown (10YR 6/4) moist; massive; very hard, firm; an estimated 10 percent, by volume, strongly cemented concretions and soft masses of calcium carbonate up to 1 inch in diameter; calcareous; moderately alkaline; gradual, wavy boundary.

C2ca—52 to 60 inches, very pale brown (10YR 7/4) clay, light yellowish brown (10YR 6/4) moist; massive; very hard, firm; few, fine, faint reddish-yellow mottles; an estimated 5 percent, by volume, strongly cemented concretions and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 34 to 48 inches in thickness. The surface has a few to about 5 percent small limestone fragments. The A horizon ranges from 20 to 36 inches in thickness and is dark grayish brown or brown in color. This horizon has from a few to about 5 percent small limestone fragments. The B horizon is as much

as 30 percent small limestone fragments. The B2 horizon ranges from 8 to 20 inches in thickness, from brown or dark brown to dark yellowish brown in color, and exclusive of coarse fragments, from clay loam to clay in texture. The C horizon ranges from grayish brawn to very pale brown and yellowish brown and has from a few films and threads to about 10 percent calcium carbonate.

Volente clay loam, 0 to 1 percent slopes (VoA).—This nearly level soil is in valleys, mainly in long, narrow areas that are parallel and adjacent to small drains, which originate in the nearby limestone hills. Soil areas range from about 10 to 200 acres in size but are commonly less than 100 acres.

This soil has the profile described as representative of the Volente series.

Included with this soil in mapping are areas of Volente clay loam that have slopes of 1 to 3 percent and small areas of Frio, Knippa, Montell, Pratley, and Uvalde soils.

Runoff is slow on this Volente clay loam, and the hazard of erosion is slight.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, kleingrass, medio bluestem, and gordo bluestem. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIc-1, dryland, and I-2, irrigated; pasture and hayland group 7C; Deep Upland range site.

Volente clay loam, 1 to 3 percent slopes (VoB).—This gently sloping soil is in valleys, mainly in long and narrow areas that are parallel and adjacent to small drains, which originate in the nearby limestone hills. Most areas are less than 40 acres in size, but they range from about 5 to 75 acres.

In a representative profile of this soil, the surface layer is about 7 inches of brown clay loam. The next layer is about 19 inches thick and is dark grayish-brown firm clay loam. The next lower layer is dark-brown firm clay about 20 inches thick. Below this is brown firm clay that reaches to a depth of 60 inches and has a few strongly cemented lime concretions.

Included with this soil in mapping are small areas of Volente clay loam that have slopes less than 1 percent and some that have slopes of 3 to 5 percent. Knippa, Pratley, and Uvalde soils are also included in mapping.

Runoff is medium on this Volente clay loam, and the hazard of erosion is moderate.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are improved bermudagrass, kleingrass, medio bluestem, and gordo bluestem. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIe-1, dryland, and IIe-2, irrigated; pasture and hayland group 7C; Deep Upland range site.

Webb Series

The Webb series consists of nearly level to gently sloping, deep, noncalcareous soils on uplands. These soils formed in sandy clay and sandy clay loam.

In a representative profile, the surface layer is brown fine sandy loam about 9 inches thick. The next layer is reddish-brown slightly acid sandy clay loam in the upper 5 inches; the lower 32 inches is very firm sandy clay that is reddish brown in the upper part and yellowish red in the lower part. The underlying material is reddish-yellow sandy clay loam that reaches to a depth of 60 inches and is about 5 to 10 percent strongly cemented concretions of lime and a few sand-stone fragments.

Webb soils are well drained. Permeability is moderately slow, and runoff is slow to medium. The available water capacity is high.

These soils are used as range and wildlife habitat, but they are suited to cultivation. Inadequate moisture is a limiting factor under dryland farming. If the soil is irrigated and properly managed, many kinds of crops can be grown.

Representative profile of Webb fine sandy loam, 0 to 1 percent slopes, 1.4 miles south of the courthouse in Uvalde, Tex., on Farm Road 117, then 13.9 miles southeast on Farm Road 140 to Kincaid Ranch Gate No. 1, then 1 mile north on private ranch road to corral, then 1.75 miles northwest to windmill, then 0.75 mile east along fence line and 100 feet north, in range.

A1—0 to 9 inches, brown (7.5YR 4/4) fine sandy loam, dark brown (7.5YR 3/4) moist; weak, fine, subangular blocky structure; hard, very friable; few fine roots and old root channels; one-fourth inch crust on surface that is brown (7.5YR 5/4); medium acid; clear, smooth boundary.

B1t—9 to 14 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; weak. fine and medium, subangular blocky structure; very hard, friable; few fine roots and old root channels; common fine pores; few thin clay films; slightly acid; clear, wavy boundary.

B21t—14 to 28 inches, reddish-brown (5YR 4/4) sandy clay, dark reddish brown (5YR 3/4) moist; moderate, fine and medium, blocky structure; very hard, very firm; few fine roots and old root channels; few thin clay films; few dark stains on some ped surfaces; slightly acid; gradual, wavy boundary.

B22t—28 to 46 inches, yellowish-red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; moderate, fine and medium, blocky structure; very hard, very firm; few fine roots and old root channels; few thin clay films; few dark stains on some ped surfaces; slightly acid; gradual, smooth boundary.

Cca—46 to 60 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; massive; hard, friable; an estimated 5 to 10 percent, by volume, strongly cemented calcium carbonate concretions; few ferro-manganese concretions; few sandstone fragments; calcareous; moderately alkaline.

The solum ranges from 36 to 60 inches in thickness. The A horizon ranges from 7 to 18 inches in thickness and is brown or reddish brown in color. The Bt horizon ranges from slightly acid through mildly alkaline in reaction. The B1t horizon ranges from 4 to 7 inches in thickness and is brown or reddish brown in color. This Bit horizon is not in some profiles. The B2t horizon is red, yellowish red, or reddish brown. A B3t horizon that has a few mottles or a few sandstone fragments is in some profiles. The C horizon ranges from red through yellowish brown and is sandy clay loam or stratified beds of weakly consolidated sandstone and sandy clay.

Part of the Webb fine sandy loam, 1 to 3 percent slopes, is outside the range of the series in that it has a thinner solum than the 40-inch limit for the series. This difference does not alter its use and management.

Webb fine sandy loam, 0 to 1 percent slopes (WeA).—This nearly level soil is in subrounded to irregular areas that range from about 15 to 50 acres in size.

This soil has the profile described as representative of the Webb series.

Included with this soil in mapping are a few areas of Webb fine sandy loam that have slopes of 1 to 3 percent and a few areas of a soil that is similar to Webb except that it has sandstone or caliche within 40 inches of the surface. Small areas of Duval and Zavco soils are also included in mapping.

Runoff is slow on this Webb fine sandy loam, and the hazard of erosion is slight. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are blue panicum and Kleberg bluestem. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIc-3, dryland, and I-3, irrigated; pasture and hayland group 8A; Tight Sandy Loam range site.

Webb fine sandy loam, 1 to 3 percent slopes (WeB).—This gently sloping soil is in subrounded to irregular areas that range from about 20 to 150 acres in size.

In a representative profile of this soil, the surface layer is brown fine sandy loam about 10 inches thick. The next layer is about 27 inches thick and is reddish-brown firm sandy clay loam in the upper 5 inches. In the lower 22 inches, it is very firm sandy clay that is yellowish red in the upper part and red-dish brown in the lower part. The underlying material is yellowish-brown weakly consolidated sandstone.

Included with this soil in mapping are a few areas of Webb fine sandy loam that have slopes less than 1 percent, a few eroded spots, and small areas of Duval, Hindes, Randado, and Zavco soils.

Runoff is medium on this Webb fine sandy loam, and the hazard of erosion is moderate.

A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnish sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are blue panicum and Kleberg bluestem. Among the management needs of good pasture are proper fertilization, weed control, and controlled grazing. In hay-fields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIe-8, dryland, and IIe-8, irrigated; pasture and hayland group 8A; Tight Sandy Loam range site.

Yologo Series

The Yologo series consists of shallow to very shallow, undulating soils. These neutral soils formed in gravelly loamy sediments.

In a representative profile, the surface layer is about 5 inches of reddish-brown, neutral gravelly loam that is about 20 percent rounded chert pebbles. The next layer is about 7 inches of firm very gravelly clay loam that is reddish brown, mildly alkaline, and about 75 percent rounded chert pebbles. The underlying material is whitish caliche that reaches to a depth of 60 inches and is indurated in the upper 2 inches and softer below.

Yologo soils are well drained. Permeability is moderate above the indurated caliche and slow in the indurated caliche. Runoff is medium, and the available water capacity is low.

These soils are used as range and wildlife habitat. They are mapped only in an undifferentiated unit with the Hindes soils.

Representative profile of Yologo gravelly loam, in an area of Hindes and Yologo soils, undulating, about 15 miles south of Sabinal, Tex., by Farm Road 187, then 0.5 mile east on a private road across Sabinal River to old ranch headquarters on Woodley Ranch, then 2.4 miles northeast along small private ranch road and 75 feet south, in range. This site is 0.3 mile east of a windmill and 0.25 mile west of a stock pond.

A1—0 to 5 inches, reddish-brown (5YR 4/3) gravelly loam, dark reddish brown (5YR 3/2) moist; weak, fine, subangular blocky structure; hard, friable; many fine roots; few fine pores and old root channels; an estimated 20 percent, by volume, water-rounded chert pebbles; neutral; clear, smooth boundary.

B2t—5 to 12 inches, reddish-brown (5YR 4/3) very gravelly clay loam, dark reddish brown (5YR 3/3) moist; moderate, fine, blocky structure; very hard, firm; many fine roots, few fine pores and old root channels; few thin clay films on peds and on coarse fragments; an estimated 75 percent, by volume, water-rounded chert pebbles and cobbles that are mainly less than 3 inches in diameter; mildly alkaline; abrupt, wavy boundary.

IIC1cam—12 to 14 inches, indurated whitish caliche plates; in upper part laminar layers are 1/16 to 3/4 inch thick; an estimated 10 percent of soil material between the plates; calcareous; moderately alkaline; abrupt, wavy boundary.

IIC2ca—14 to 60 inches, whitish caliche of about clay loam texture; massive; hard, friable; about 2 percent soil material, similar to soil in B2t horizon, as lenses and pockets; calcareous; moderately alkaline.

The solum ranges from 8 to 19 inches in thickness and corresponds to the depth to indurated caliche. The solum ranges from slightly acid to mildly alkaline in reaction. The A horizon ranges from 2 to 14 inches in thickness, from dark grayish brown to brown or reddish brown in color, and exclusive of coarse fragments, is loam or sandy clay loam in texture. The A horizon ranges from 20 to 75 percent coarse fragments.

The B2t horizon ranges from 5 to 12 inches in thickness, is dark brown or reddish brown, and ranges from clay loam to sandy clay loam. This horizon ranges from 35 to 80 percent coarse fragments. The IIC1cam horizon ranges from a one-fourth inch, strongly cemented and laminar, caliche layer over slightly hardened caliche to layers 6 inches thick that are strongly cemented and laminar throughout. The IIC2ca horizon is weakly cemented to soft caliche and in places contains chert pebbles.

Zapata Series

The Zapata series consists of gently sloping to sloping, very shallow, calcareous soils on uplands. These soils formed over thick beds of caliche.

In a representative profile, the surface layer is about 5 inches of light brownish-gray friable loam that contains many fine caliche fragments. The underlying material is white caliche that is indurated in the upper 4 inches and weakly cemented below.

Zapata soils are well drained. Permeability is moderate, and runoff is medium. The available water capacity is low. These soils are used as range and wildlife habitat, and caliche is mined on some of them.

Representative profile of Zapata loam, in an area of Zapata soils, 1.25 miles south by southwest of Cline, Tex., by a county road, then past the end of the road, in range.

A1—0 to 5 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky and granular structure; hard, friable; few fine roots and old root channels; one-fourth inch crust on surface that has platy structure; many fine indurated caliche fragments

1 to 8 millimeters in diameter, few indurated caliche fragments up to 6 inches in diameter; calcareous; moderately alkaline; abrupt, wavy boundary.

C1cam—5 to 9 inches, white (10YR 8/2) caliche; indurated, fractured; small amount of light brownish-gray loam in fractures; calcareous; moderately alkaline; clear, wavy boundary.

C2—9 to 30 inches, white (10YR 8/2) caliche; weakly cemented; brittle; calcareous; moderately alkaline.

The solum ranges from 3 to about 10 inches in thickness and contains from a few to 25 percent coarse fragments of angular caliche that are 1 to 8 inches long and chert gravel. The A horizon is grayish brown, light brownish gray, brown, or pale brown. This horizon is loam or clay loam and ranges from 40 to 70 percent calcium carbonate. The Ccam horizon ranges from indurated to strongly cemented, and it does not have soil fines in some profiles.

Zapata soils (Za).—The soils in this mapping unit are in subrounded to irregular areas that range from about 20 to 400 acres in size. Slopes are mainly 2 to 5 percent but range from 1 to 8 percent. This mapping unit is about 67 percent Zapata soils and about 33 percent of a soil that is similar to Zapata soil except it is 10 to 20 inches deep over caliche. This similar soil is not in all mapped areas.

Included in this mapping unit are small areas of Ector, Olmos, Uvalde, and Valco soils.

The hazard of erosion is moderate on this mapping unit, and erosion is active. Capability unit VIIs-5, dryland; Shallow Ridge range site.

Zavco Series

The Zavco series consists of nearly level to gently sloping noncalcareous soils on uplands. These soils formed in sandy clay and sandy clay loam.

In a representative profile, the surface layer is brown sandy clay loam that is mildly alkaline, friable, and about 9 inches thick. The next layer is about 33 inches thick. It is reddish-brown, mildly alkaline, friable sandy clay loam in the upper 8 inches; reddish-brown, mildly alkaline. firm sandy clay in the middle 11 inches; and yellowish-red, moderately alkaline, firm sandy clay in the lower 14 inches. The underlying material, about 12 inches thick, is reddish-yellow sandy clay loam that is about 20 percent sandstone fragments and about 5 percent strongly cemented concretions and soft masses of lime. Below a depth of 54 inches is weakly consolidated sandstone.

Zavco soils are well drained. Permeability is moderately slow, and runoff is slow to medium. The available water capacity is high.

These soils are used as range and wildlife habitat, but they are suited to cultivation. Inadequate moisture is a limiting factor under dryland farming. If the soils are irrigated and properly managed, many kinds of crops can be grown.

Representative profile of Zavco sandy clay loam, 1 to 3 percent slopes, 1.4 miles south of the courthouse in Uvalde, Tex., on Farm Road 117, then 9.9 miles southeast on Farm Road 140 to Kincaid Ranch Gate No. 13, then 3,000 feet northwest on private ranch road and 100 feet west, in range.

A1—0 to 9 inches, brown (7.5YR 4/2) sandy clay loam, dark brown (7.5YR 3/2) moist; weak, fine and medium, subangular blocky structure; hard, friable; many fine roots; few fine pores and old root channels; few worm casts; one-fourth inch crust on surface that is slightly lighter in color; mildly alkaline; clear, smooth boundary.

B1t—9 to 17 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; moderate, fine and medium, subangular blocky

structure; hard, friable; many fine roots, many fine pores, and old root channels; few thin clay films; few worm casts; mildly alkaline; gradual, smooth boundary.

B2t—17 to 28 inches, reddish-brown (5YR 4/4) sandy clay, dark reddish brown (5YR 3/4) moist; moderate, medium, subangular and blocky structure parting to moderate, fine, blocky; vary hard, firm; few fine roots, few fine pores and old root channels; common thin clay films; few worm casts; few flecks of calcium carbonate in lower part; mildly alkaline; clear, wavy boundary.

B3t—28 to 42 inches, yellowish-red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; weak, fine and medium, subangular blocky and blocky structure; very hard, firm; few fine roots; few strongly cemented concretions of calcium carbonate 1 to 3 millimeters in diameter; few threads of segregated calcium carbonate; few chert fragments that have calcium carbonate coatings; -calcareous; moderately alkaline; gradual, wavy boundary.

Cca—42 to 54 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; massive; hard, friable; an estimated 20 percent, by volume, soft and hard yellowish-brown sandstone fragments that have patchy coatings of calcium carbonate; an estimated 5 percent, by volume, strongly cemented concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; abrupt, wavy boundary.

R—54 to 55 inches, weakly consolidated sandstone; thin coating of calcium carbonate on upper surface; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. Between depths of 10 to 28 inches is secondary lime. The dark surface ranges from 10 to 20 inches in thickness and usually includes the upper part of the Bt horizon.

The A horizon ranges from 8 to 16 inches in thickness, from brown, dark brown, or reddish brown to grayish brown or dark grayish brown in color, and from slightly acid to mildly alkaline in reaction.

The B1t horizon ranges from 6 to 11 inches in thickness, is reddish brown or brown in color, is sandy clay loam or sandy clay in texture, and ranges from slightly acid to mildly alkaline in reaction. The B2t horizon ranges from 6 to 22 inches in thickness, is reddish brown or brown in color, ranges from sandy clay to clay in texture, and ranges from mildly alkaline to moderately alkaline in reaction. The B3t horizon is absent in some profiles. Where present, the B3t horizon ranges from mildly alkaline to moderately alkaline in reaction.

A Cca horizon is in most profiles and is as much as 10 percent visible carbonates as soft masses or concretions. The R layer ranges from weakly consolidated sandstone that has a calcium carbonate coating on the upper surface to a mixture of sandstone and calcium carbonate in about equal parts.

Zavco sandy clay loam, 0 to 1 percent slopes (ZaA).—This nearly level soil is mainly in subrounded to irregular areas but also is in narrow areas along and in association with small drains. Soil areas range from about 10 acres to as much as 200 acres in size.

In a representative profile of this soil, the surface layer is brown friable sandy clay loam about 16 inches thick. The next layer is about 10 inches of reddish-brown firm sandy clay. Below this is about 22 inches of brown firm sandy clay that has a few small concretions of lime in the lower part. The underlying material is reddish-yellow sandy clay loam that reaches to a depth of 60 inches and is about 5 percent soft masses of lime.

Included with this soil in mapping are a few areas of Zavco sandy clay loam that have slopes of 1 to 3 percent and a few areas of a similar soil except that it has

sandstone or caliche within 40 inches of the surface. Small areas of Caid, Duval, Hindes, and Webb soils also are included in mapping.

Runoff is slow on this Zavco sandy clay loam, and the hazard of erosion is slight. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants for pasture and hay are blue panicum, Kleberg bluestem, and buffelgrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIc-2, dryland, and 1-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

Zavco sandy clay loam, 1 to 3 percent slopes (ZcB).—This gently sloping soil is in subrounded to irregular areas that range from about 15 to 200 acres in size. Slopes are mainly 1 to 2 percent.

This soil has the profile described as representative of the Zavco series.

Included with this soil in mapping are a few areas that have slopes of less than 1 percent and a few areas of a similar soil except that it has sandstone or caliche within 40 inches of the surface. Small areas of Caid, Duval, Hindes, and Webb soils also are included in mapping.

Runoff is medium on this Zavco sandy clay loam, and the hazard of erosion is moderate. A good cropping system for cultivated areas utilizes crops that protect the soil during the growing season and furnishes sufficient residue to protect the soil between crops. Terraces and contour farming help to control erosion and conserve moisture. A well-designed irrigation system and proper water management are needed if the soil is irrigated.

The main adapted plants used for pasture and hay are blue panicum, Kleberg bluestem, and buffelgrass. Among the management needs of good pastures are proper fertilization, weed control, and controlled grazing. In hayfields, fertilization, weed control, and cutting hay at the recommended height and growth stage are equally important. Capability unit IIIe-2, dryland, and IIe-2, irrigated; pasture and hayland group 7C; Clay Loam range site.

Use and Management of the Soils

In this section the uses of soils, the basis for judging the fitness of a soil for a particular use, and placement of the soils into groupings according to their fitness for a particular use are discussed.

The soils of Uvalde County are used mainly for dryland and irrigated crops, pasture and hay, and as range and wildlife habitat. The first subsection examines soils as a medium for growth of dryland and irrigated crops, the management practices required, and crop yields to be expected. Use of soils for pasture and hay are then discussed, followed by a discussion of improved and native range. The soils are then examined as a major factor in determining wildlife habitat.

The fifth subsection discusses a more intensified use of the soils—for engineering purposes, as a building material, or as a foundation material for structures.

The interpretations in these subsections are based on the detailed soil profiles, test results, and observations by many people who work with the soils in scientific, technical, and land use capacities. Much of the information is in tabular form for ease of reference. Many additional interpretations can be made from the basic information in this survey.

Use of the Soils for Crops, Pasture, and Hay

Gerald M. Darby, field specialist in agronomy, Soil Conservation Service, assisted in preparing this section.

In Uvalde County, crops, pasture, and hay are grown on about 130,000 acres. Dryland crops are grown on about 94,000 acres, irrigated crops on 30,000 acres, dryland pasture and hay on 320 acres, and irrigated pasture and hay on 2,800 acres. The trend in the past 10 years has been toward a slight decrease in dryland crops and a slight increase in irrigated crops. The major dryland crops are grain sorghum, forage sorghum, and small grain. The major irrigated crops are grain sorghum, cotton, corn, and many kinds of truck crops. The major dryland pasture and hay grasses are blue panicum, buffelgrass, King Ranch bluestem, kleingrass, and medio bluestem. The major irrigated pasture and hay grass is improved bermudagrass.

Management of the soils for dryland crops

The conservation of moisture is the major objective of the management of soils in Uvalde County because rainfall is limited and evaporation and transpiration of moisture are high. Maintenance of fertility and erosion control are also important. Farming practices that help to efficiently utilize the rainfall and protect the land from erosion can increase the growth rate of the major dryland crops, which are grain sorghum, forage sorghum, and small grain.

Conservation cropping systems, crop residue management, minimum tillage, and proper use of fertilizer are needed on all cultivated soils. On many of the nearly level soils, contour farming, alone or in conjunction with terracing, helps to control runoff by holding the rainfall on the land until it can be absorbed by the soil. In some of the steeper areas, contour farming, field terracing, diversion terracing, and grassed waterways are needed to control erosion and conserve water.

The crops that are normally grown in Uvalde County are easily adapted to a conservation cropping system. Where soil conditions are favorable, the crops produce enough residue to maintain soil tilth, if the residue is kept on or near the surface.

Crop residue that is left on the surface protects the soil against packing rains, reduces crusting, increases the intake of water, decreases runoff and erosion, and reduces evaporation of moisture. In addition, it improves the tilth of the surface layer and reduces packing caused by farm machinery.

Tillage should be sufficient to prepare a good seedbed and control weeds but not enough either to damage the structure of the soil, especially when wet, or to encourage formation of a plowpan. Poor structure limits intake of water and reduces the air space in the soil. A plowpan restricts root growth. Poor soil structure and plowpans slow the penetration of water and consequently cause an increase in runoff and erosion.

Although Uvalde County soils normally respond to fertilizers, the response may not be economical in dry years. A rule-of-thumb is to apply fertilizer during the growing season when the top 2 feet of soil has all the moisture it will hold against the pull of gravity (field capacity) and when the surface is dry enough for tillage. For small grain, the fertilizer can be applied from planting time through February and for grain sorghum, from February through April 30. Forage sorghum responds through September 15.

The best guide to follow for fertilizing is a chemical analysis of the soil plus an estimation of the nutrient requirements of the crop to be grown. Normally some general rules apply, however. The soils need nitrogen and phosphorous, but potassium is adequate. Nitrogen and phosphorus are needed in a ratio of about 1 to 1 for oat grain and maize production, a ratio of about 2 to 1 for oat grazing, and a ratio of 3 to 1 for forage sorghum. An annual soil test will detect buildup or depletion of required nutrients for each crop.

Terraces designed to reduce runoff can be used in conjunction with contour farming to conserve moisture, to help control erosion, or to divert water from cultivated areas or other areas that need protection. Parallel terraces permit farming on the approximate contour without the inconvenience of having short rows between terraces. This increases the efficiency of large equipment. Contour farming should be used with terraces where the slope gradient is 1 percent or more. Contour farming alone can be used effectively on nearly level fields where terraces are not needed.

Grassed waterways are needed with some terrace systems to carry outside water across fields. These should be built according to engineering specifications. In most cases, they need to be planted to a perennial grass. Depending upon the soil, Coastal bermudagrass or King Ranch bluestem are the more suitable grasses. Once the grass is established, it can be grazed or harvested for hay or seed.

Management of the soils for irrigated crops

An approximate total of 30,000 cultivated acres in Uvalde County is irrigated with water pumped primarily from the Edwards Limestone formation or the Leona Gravel formation. Large areas of nearly level soils are suited to farming with water applied by surface gravity flow.

The major irrigated crops are vegetables, cotton, corn, and grain sorghum. The main vegetables are cabbage, carrots, and onions. Improved bermudagrass and small grain for grazing also are irrigated. Fertilizing, management of crop residues, and weed and insect control are important to a successful cropping system.

The controlled application of water is essential. A carefully engineered irrigation system is needed so that the water is applied evenly and efficiently. Earth-moving equipment is used in some places to level or grade the fields so that water can be evenly applied.

Capability grouping

Some readers, particularly those who farm on a large scale, may find it practical to use and manage alike some of the different kinds of soil on their farm. These readers can make good use of the capability classification system, a grouping that shows, in a general way, the suitability of soils for most kinds of farming.

The grouping is based on permanent limitations of soils when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations for range or engineering.

In the capability system, the kinds of soils are grouped at three levels: the class, the subclass, and the unit. The broadest grouping, the capability class, is designated by Roman numerals I to VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

The subclass indicates major kinds of limitations within the classes. Within most of the classes there can be as many as four subclasses. The subclasses are indicated by adding a small letter, e, w, s, or c, to the class numeral, for example, IIe. The letter “e” shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; “w” means that water in or on the soil interferes with plant

growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); “s” shows that the soil is limited mainly because it is shallow, droughty, or stony; and “c” indicates that the chief limitation is climate that is too dry.

Class I has no subclasses because the soils of this class have few or no limitations. Class V can contain, at the most, only the subclasses indicated by w, s, and c, because the soils in it are subject to little or no erosion. This class has other limitations, however, that restrict its use largely to pasture, range, or wildlife.

Subclasses are further divided into groups called capability units. These are groups of soils that are so much alike that they are suited to the same crops and pasture plants, they require about the same management, and they have generally similar productivity and other response to management. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIc-2.

Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In Uvalde County, the soils are grouped according to both irrigated and dryland uses. Thus, Conalb loam is classified I-1 where irrigated and IIIc-1 where dryfarmed.

The eight classes in the capability system and the subclasses and units in Uvalde County are described in the list that follows. The unit designation for each soil is given in the Guide to Mapping Units.

CLASSIFICATION OF IRRIGATED CAPABILITY UNITS

Class I. Soils have few limitations that restrict their use. (No subclasses in Class I soils.)

- Unit 1-1. Deep, nearly level to gently sloping, moderately and moderately slowly permeable loams and silty clay loams of the bottom lands.
- Unit I-2. Deep, nearly level, moderately and moderately slowly permeable sandy clay loams, clay loams, and silty clay loams of the uplands.
- Unit I-3. Deep, nearly level, moderately slowly permeable fine sandy loams of the uplands. Webb fine sandy loam, 0 to 1 percent slopes, is the only soil in this unit.

Class II. Soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Subclass IIe. Soils subject to moderate erosion if they are not protected.

- Unit IIe-1. Deep, gently sloping, moderately permeable loams of the uplands. Atco loam, 1 to 3 percent slopes, is the only soil in this unit.
- Unit IIe-2. Deep to moderately deep, moderately permeable to moderately slowly permeable clays, silty clay loams, clay loams, and sandy clay loams of the uplands.
- Unit IIe-3. Deep, gently sloping, slowly permeable clay loams of the uplands. The Dant part of Dant and Uvalde soils, 1 to 3 percent slopes, is the only soil in this unit.
- Unit IIe-4. Deep, gently sloping, moderately permeable fine sandy loams of the uplands. Duval fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit.
- Unit IIe-5. Deep, gently sloping, moderately slowly permeable silty clay loams of the bottom lands. Frio silty clay loam, 1 to 3 percent slopes, is the only soil in the unit.
- Unit IIe-6. Shallow, gently sloping, moderately permeable fine sandy loams of the uplands. Randado fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit.

Unit IIe-7. Deep, gently sloping, moderately permeable clay loams of the uplands. Sabenyo clay loam, 1 to 5 percent slopes, is the only soil in this unit.

Unit IIe-8. Deep, gently sloping, moderately slowly permeable fine sandy loams of the uplands. Webb fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit.

Subclass IIs. Soils have moderate limitations because of soil conditions.

Unit IIs-1. Deep, nearly level, moderately permeable loams that are very high in lime on the uplands. Atco loam, 0 to 1 percent slopes, is the only soil in this unit.

Unit IIs-2. Deep, nearly level, slowly and moderately slowly permeable clay loams and clays of the uplands.

Unit IIs-3. Deep to moderately deep, nearly level, very slowly permeable clays of the uplands.

Class III. Soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Subclass IIIe. Soils are subject to severe erosion if they are not protected.

Unit IIIe-1. Shallow, nearly level to gently sloping, moderately to moderately slowly permeable clays and clay loams of the uplands.

Unit IIIe-2. Deep to moderately deep, nearly level to gently sloping, very slowly permeable clays of the uplands.

Subclass IIIs. Soils have severe limitations because of soil conditions.

Unit IIIs-1. Deep, nearly level to gently sloping, moderately rapidly permeable fine sands of the uplands. Comitas fine sand, sandy subsoil variant, is the only soil in this unit.

Class IV. Soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Subclass IVw. Soils have very severe limitations because of excess water.

Unit IVw-1. Deep, nearly level, very slowly permeable clays that receive extra water in depressions and drains. Mercedes clay is the only soil in this unit.

Class V. Soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, or wildlife habitat.

Subclass Vw. Soils have limitations because of excess water.

Unit Vw-1. Deep, nearly level, moderately slowly permeable silty clay loams that are frequently flooded on bottom lands. Frio silty clay loam, frequently flooded, is the only soil in this unit.

Class VI. Soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range or wildlife habitat. There are no Class VI irrigated soils in Uvalde County.

Class VII. Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range or wildlife habitat. There are no Class VII irrigated soils in Uvalde County.

Class VIII. Soils and landforms that have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes. There are no Class VIII irrigated soils in Uvalde County.

CLASSIFICATION OF DRYLAND CAPABILITY UNITS

Class I. Soils have few limitations that restrict their use. (No Class I dryland soils in Uvalde County.)

Class II. Soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Subclass IIe. Soils subject to moderate erosion if they are not protected.

Unit IIe-1. Deep, gently sloping, moderately and moderately slowly permeable clay loams of the uplands.
Unit IIe-2. Deep, gently sloping, moderately slowly permeable silty clay loams of the bottom lands. Frio silty clay loam, 1 to 3 percent slopes, is the only soil in this unit.
Unit IIe-3. Deep, nearly level and gently sloping, moderately slowly permeable clays of the uplands.

Subclass IIs. Soils have moderate limitations because of soil conditions.
Unit IIs-1. Deep, nearly level, moderately slowly permeable clays of the uplands. Knippa clay, 0 to 1 percent slopes, is the only soil in this unit.

Subclass IIc. Soils have moderate limitations because of dry climate.
Unit IIc-1. Deep, nearly level, moderately to moderately slowly permeable clay loams of the uplands.
Unit IIc-2. Deep, nearly level, moderately slowly permeable silty clay loams of the bottom lands. Frio silty clay loam, 0 to 1 percent slopes, is the only soil in this unit.
Unit IIc-3. Deep, nearly level, moderately permeable sandy clay loams of the uplands. Ramadero sandy clay loam is the only soil in this unit.

Class III. Soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Subclass IIIe. Soils subject to high erosion if they are not protected.
Unit IIIe-1. Deep, gently sloping, moderately permeable loams that are very high in lime, on uplands. Atco loam, 1 to 3 percent slopes, is the only soil in this unit.
Unit IIIe-2. Deep, gently sloping, moderately permeable to moderately slowly permeable silty clay loams and sandy clay loams of the uplands.
Unit IIIe-3. Deep, nearly level to gently sloping, moderately rapidly permeable fine sands of the uplands. Comitas fine sand, sandy subsoil variant, is the only soil in this unit.
Unit IIIe-4. Deep, gently sloping, slowly permeable clay loams of the uplands. The Dant portion of Dant and Uvalde soils, 1 to 3 percent slopes, is the only soil in this unit.
Unit IIIe-5. Deep, gently sloping, moderately permeable fine sandy loams of the uplands. Duval fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit.
Unit IIIe-6. Shallow, nearly level to gently sloping, moderately slowly permeable clays of the uplands. Kavett clay, 0 to 3 percent slopes, is the only soil in this unit.
Unit IIIe-7. Moderately deep, nearly level to gently sloping, very slowly permeable clays of the uplands. Topia clay, 0 to 3 percent slopes, is the only soil in this unit.
Unit IIIe-8. Deep, gently sloping, moderately slowly permeable fine sandy loams of the uplands. Webb fine sandy loam, 1 to 3 percent slopes, is the only soil in the unit.

Subclass IIIs. Soils have severe limitations because of soil conditions.
Unit IIIs-1. Deep, nearly level, moderately permeable loams that are very high in lime, on uplands. Atco loam, 0 to 1 percent slopes, is the only soil in this unit.
Unit IIIs-2. Deep, nearly level, slowly permeable clay loams of the uplands. The Dant part of Dant and Uvalde soils, 0 to 1 percent slopes, is the only soil in this unit.
Unit IIIs-3. Moderately deep, nearly level, very slowly permeable clays of the uplands. San Saba clay is the only soil in this unit.

Subclass IIIc. Soils have severe limitations because of the dry climate.

Unit IIIc-1. Deep, nearly level to gently sloping, moderately permeable loams of the bottom lands.
Unit IIIc-2. Deep, nearly level, moderately to moderately slowly permeable silty clay loams and sandy clay loams of the uplands.
Unit IIIc-3. Deep, nearly level, moderately slowly permeable fine sandy loams of the uplands. Webb fine sandy loam, 0 to 1 percent slopes, is the only soil in this unit.

Class IV. Soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
Subclass IVe. Soils subject to very severe erosion if they are not protected.
Unit IVe-1. Deep, gently sloping, very slowly permeable clays of the uplands.
Unit IVe-2. Shallow, gently sloping, moderately permeable fine sandy loams of the uplands. Randado fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit.
Unit IVe-3. Deep, gently sloping, moderately permeable clay loams of the uplands. Sabenyo clay loam, 1 to 5 percent slopes, is the only soil in this unit.
Subclass IVw. Soils have very severe limitations because of excess water.
Unit IVw-1. Deep, nearly level, very slowly permeable clays that receive extra water in depressions and drains. Mercedes clay is the only soil in this unit.
Subclass IVs. Soils have very severe limitations because of soil conditions.
Unit IVs-1. Deep, nearly level, very slowly permeable clays of the uplands.
Unit IVs-2. Shallow, nearly level to gently sloping, moderately permeable clay loams of the uplands. Valco clay loam, 0 to 3 percent slopes is the only soil in this unit.

Class V. Soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, or wildlife habitat.
Subclass Vw. Soils have limitations because of excess water.
Unit Vw-1. Deep, nearly level, moderately slowly permeable silty clay loams that are frequently flooded, on bottom lands. Frio silty clay loam, frequently flooded, is the only soil in this unit.

Class VI. Soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range or wildlife habitat.
Subclass VIw. Soils are severely limited because of excess water.
Unit VIw-1. Shallow to gravel, nearly level, moderately rapidly to rapidly permeable, very gravelly clay loams and fine sandy loams that are frequently flooded, on bottom lands.
Subclass VIs. Soils are severely limited because of soil conditions.
Unit VIs-1. Very shallow and shallow, undulating, moderately to moderately slowly permeable gravelly clay loams and loams of the uplands.
Unit VIs-2. Moderately deep to deep, undulating, moderately to moderately slowly permeable gravelly clay loams and gravelly sandy clay loams of the uplands.
Unit VIs-3. Shallow, undulating, slowly permeable clays of the uplands. Speck soils, undulating, are the only soils in this unit.
Unit VIs-4. Moderately deep, nearly level, very slowly permeable stony clays of the uplands. San Saba stony clay is the only soil in this unit.

Class VII. Soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, range, or wildlife habitat.
Subclass VIIe. Soils are subject to very severe erosion if they are not protected.

Unit VIIe-1. Gently sloping exposed clayey materials that contain many fossils, on uplands. Badland is the only mapping unit in this capability unit.

Subclass VIIs. Soils have very severe limitations because of soil conditions.

Unit VIIs-1. Shallow and very shallow, hilly, moderately to moderately slowly permeable loams and gravelly clay loams of the uplands. Brackett and Real soils, hilly, is only component of this unit.

Unit VIIs-2. Shallow to very shallow, hilly, moderately to moderately slowly permeable gravelly loams of the uplands.

Unit VIIs-3. Shallow to very shallow, undulating, moderately permeable gravelly loams of the uplands. The Yologo part of Hindes and Yologo soils, undulating, is the only soil in this unit.

Unit VIIs-4. Moderately deep to deep, nearly level to gently sloping and hilly, slowly permeable stony and gravelly clays of the uplands.

Unit VIIs-5. Shallow to very shallow, undulating and gently sloping to sloping, moderately permeable loams to gravelly loams of the uplands.

Class VIII. Soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to esthetic purposes.

Subclass VIIIs. Landforms are severely restricted in use due to lack of soil.

Unit VIIs-1. Steep, miscellaneous land type dominated by exposures of limestone bedrock. Limestone rock land is the only soil in this unit.

Unit VIIIs-2. Steep, miscellaneous land type of Rock outcrop or rock land.

Management of the soils for dryland and irrigated pasture and hay

In Uvalde County a total of 3,120 acres is used for pasture and hay, and about 2,800 acres of this is irrigated. This acreage is in perennial grasses and does not include land on which annual crops are grown for livestock forage. Among the management and conservation practices that need to be considered in a pasture or hay program are the use of adapted plants, proper fertilization, weed control, and controlled grazing. If the soil is irrigated, water management is important.

Few grasses are adapted to dryland. Blue panicum, which has the highest production capacity, kleingrass 75, Kleberg bluestem, and King Ranch bluestem do well on clay and clay loam soils. King Ranch bluestem does better in the Edwards Plateau part of the county than it does in the Rio Grande Plain part. Weeping lovegrass, Coastal bermudagrass, and blue panicum are adapted to the sandier soils in the county.

Many grasses are adapted to irrigated pastures. Coastal bermudagrass is the most versatile plant of all. Other suitable grasses are blue panicum, medio bluestem, gordo bluestem, Bell rhodesgrass, kleingrass 75, johnsongrass, and weeping lovegrass.

Only one kind of grass should be planted in each pasture because differences in growth rate, palatability, and nutrient and water requirements make management difficult.

On dryland pasture and hay, grasses normally respond to fertilizer, but the response may not be economical. The use of fertilizer helps to establish the grass, especially where cultivated land is being returned to pasture.

Irrigated soils respond well to fertilizer. A chemical analysis of the soil helps to determine the kind and amount of fertilizer needed, but some general rules apply. The soils need nitrogen and phosphorus. Potassium is adequate in most places. Perennial grasses remove nitrogen and phosphorus from the soil in a ratio of about 4 to 1 and should be added in that ratio.

Proper grazing or cutting that maintains enough leaves on a plant to allow the plant to manufacture food and continue the life process is important in the production

of forage or hay. Cutting or grazing heights are dependent on kind of grass, growth stage, fertilization rate, and available moisture. Recommendations can be obtained from the Nueces-Frio-Sabinal Soil and Water Conservation District Office, the Texas Agricultural Extension Service, or the Texas Agricultural Experiment Station.

On irrigated land, grazing should be rotated and coordinated with the irrigating schedule. After being irrigated, most soils need a few days to dry before animals are returned because grazing wet soils causes deterioration of soil structure.

Controlled grazing on dryland helps minimize drought damage and allows periodic natural reseeding.

On irrigated land that is properly harvested and fertilized, the vigorous grass growth crowds out weeds. On dryland, weeds can be mowed or killed with a hormone type herbicide. The latter method is generally more effective and does not damage the grass as does mowing.

High production from irrigated pasture and hay requires large amounts of water. A ten-ton production per acre of Coastal bermudagrass hay utilizes at least thirty-acre inches of water and may require much more. The higher the fertility level, the more efficiently the water use. A rule-of-thumb is to plan for 5 inches of water from rainfall or irrigation for each ton of hay produced. The rule also applies to forage for grazing, but it is related to dry forage and not tons of green material. The irrigation water should be applied evenly to all parts of the field when production is desired.

Pasture and hayland grouping

The soils suitable for pasture and hay are grouped in this section according to their suitability for certain grasses, their potential productivity, and their treatment needs. Both dryland and irrigated groups are described briefly in the following paragraphs. The “Guide to Mapping Units” at the back of this survey shows the pasture and hayland group for each soil that is suited to this use.

Pasture and hayland group 1C.—Deep silty clay loams that are moderately slowly permeable, have high available water capacity, and are on bottom lands. Flooding is infrequent to frequent, but brief.

Pasture and hayland group 2A.—Deep loams of the bottom lands that are moderately permeable and have a high available water capacity. Flooding is infrequent.

Pasture and hayland group 7A.—Deep and moderately deep clays and clay loams of the uplands that are very slowly to slowly permeable and have a high available water capacity.

Pasture and hayland group 7C.—Deep and moderately deep loams, sandy clay loams, clay barns, silty clay barns, and clays of the uplands that are moderately to moderately slowly permeable and have a high available water capacity.

Pasture and hayland group 8A.—Deep fine sandy loams of the uplands that are moderately slowly permeable and have a high available water capacity.

Pasture and hayland group 8C.—Deep fine sandy loams of the uplands that are moderately permeable and have a moderate available water capacity.

Pasture and hayland group 9A.—Deep fine sands of the uplands that are moderately rapidly permeable and have a low available water capacity.

Pasture and hayland group 13A.—Shallow to deep clays and clay loams of the uplands that are moderately slowly to moderately permeable and have a low to moderate available water capacity.

Pasture and hayland group 14A.—Shallow very gravelly clay barns and fine sandy loams of the bottom lands and uplands that are moderately to moderately rapidly permeable and have a low available water capacity.

Estimated yields

Table 2 gives the estimated average yields per acre for the main crops grown in the county under dryland and irrigated farming. These are the average yields that can be expected over a period of years under a high level of management. They are based on information obtained from research and from interviews with farmers and others who have knowledge of the soils. Crops other than those named are grown in the county, but they are not grown on a large acreage, and reliable yield data are not available. Only arable soils are listed.

Under a high level of management, all of the following practices are used on dryland and irrigated soils:

1. Rainfall is conserved.
2. Runoff is controlled.
3. Soil-improving crops, cover crops, and crops that produce a large amount of residue are used.
4. High-quality seed of adopted and improved varieties is used.
5. Soil fertility is maintained by timely application of the proper kind and amount of fertilizer according to soil analysis and crop needs.
6. Crop residue is properly managed.
7. Weeds, insects, and plant diseases are controlled by consistent use of effective measures.
8. Tillage is minimum but timely.
9. Proper timing and methods of harvesting are employed.
10. Pasture is fertilized; weeds, insects, and diseases are controlled; and grazing is controlled.

The following additional practices are used if the soils are irrigated:

1. A properly designed irrigation system is used.
2. Water is applied according to the kind of soil and the needs of the crop.
3. The soils are not tilled when wet.

Use of the Soils for Range

By Donald T. Pendleton, field specialist in range, Soil Conservation Service.

Range is land on which the climax, or natural potential, plant community is composed principally of grasses, grass-like plants, forbs, and shrubs that are valuable for grazing and growing in sufficient quantity to justify grazing use. Native grassland makes up about 87 percent of the total acreage of Uvalde County and amounts to 886,320 acres. This range is used mainly to raise cattle, sheep, and goats. Multiple land use has become increasingly important in recent years. Among the significant secondary land uses are use as wildlife habitat and as recreation areas.

The northern half of the county is in the Edwards Plateau and is nearly level to very steep limestone areas in which the soils are predominantly shallow or very shallow and stony. Live oak trees are the major overstory in the plant community. The southern half of the county is in the Rio Grande Plain and is level to gently rolling soils. Mesquite, blackbrush acacia, and guajillo are the main woody plants on these soils.

The history of grazing by domestic animals in Uvalde County dates back to the 1860's. The first fences were built about 1887, and many cattle were introduced into the area about that time. Heavy and continuous grazing and periodic droughts caused the better native plants to decrease in the plant community and the brush and less desirable plants to increase. Denuded range and the burning off of the thorns and the feeding of pricklypear cactus, both caused by drought, were reported as early as 1888.

Range sites and condition classes

A range site is a distinctive kind of rangeland that differs from other kinds of rangeland in its potential to produce native plants.

Different soils are grouped into range sites according to their ability to produce different kinds or proportions of plants or according to their total annual yield. Each range site has the ability to support a plant community that is an association of kinds of plants significantly different from those found on any other site. These sites also differ in their management needs and in the kind and number of grazing animals they can safely support. A knowledge of the kind and amount of plants that can be grown on a particular site is necessary so that the site can be properly man-aged.

Before being grazed by domestic livestock, the vegetation that grew on each site was the potential, or climax, plant community and was made up of a mixture of many kinds of plants. Some of the plants grew best in the cool season, and some grew best in the warm season. Some grew tall and others were short. Some were deep rooted and others shallow rooted. Some were palatable to grazing animals and others were not.

Livestock and game animals graze selectively, repeatedly grazing or browsing those plants that they like best. Continuous heavy grazing for extended periods reduces plant vigor and competitive ability and eventually results in the elimination of the plant. Those plants that are eliminated first from the climax plant community are called decreasers because of their initial response to continuous heavy grazing. These decreasers are generally the most palatable and productive plants that the site is capable of growing.

After continued heavy use, the decreaser plants begin to die out of the plant community, and certain other secondary plants begin to replace them. Because they are not as palatable, these plants are not grazed as often or as closely as are the decreasers. Hence, under heavy grazing they have the advantage in competing with the decreasers for space, sunlight, plant nutrients, and water. These plants are known as increasers because of their initial response to continuous heavy grazing.

Since the terms decreaser and increaser indicate the initial response of plants to continuous heavy use, it is important to specify the kind of grazing animal using the plant community. Because animals have different forage preferences, a grass plant that is a decreaser under cattle grazing might not necessarily be a decreaser if it is grazed by goats or deer.

When the decreasers are eliminated from a climax plant community, grazing animals turn to the increasers as their primary source of forage. Increasers are ordinarily less productive than decreasers. So unless the grazing pattern that eliminated the decreasers is altered, the increasers, too, will be overused, decline in vigor, and begin to disappear from the plant community.

Where this occurs, decreasers and increasers are on the decline; plants that are not native to the site move in. These plants are known as invaders. Usually, invaders have special adaptations, such as spines, thorns, burrs, toxins, or low palatability that prevent their overuse by grazing animals. Invaders are generally less productive than climax plants, and their yields are less reliable.

Forage plants on all sites respond well to proper grazing use and deferred grazing. Where trees and brush are dense, forage production can be improved by controlling the undesirable plants with herbicides or by mechanical methods. Successful seeding on sites usually requires seedbed modification following mechanical brush control. For best results, it is necessary to defer grazing on the treated area until the desirable grasses are established.

Range condition is the present state of the vegetation of a range site in relation to the potential plant cover for that site. Range condition classes measure the degree to which the present plant composition, expressed in percent, resembles that of the

potential plant community of a range site. The Uvalde County range is classified into four range condition classes according to the present percentage of original or potential vegetation. A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as the original, or climax, vegetation. It is in good condition if the percentage is 51 to 75, in fair condition if the percentage is 26 to 50, and in poor condition if the percentage is less than 25.

Descriptions of range sites

This subsection describes each of the range sites in Uvalde County and the climax vegetation of these sites. The terms “decreasers” and “increasers” as used in this section describe the initial response of climax plants to continuous heavy grazing by cattle. Range condition is discussed, and the predicted yield of total herbage, including that produced by woody plants, is given for each site in excellent condition.

The components of soil mapping units that serve to delineate range sites may consist of one or more soil phases, complexes, associations, or undifferentiated units.

The range site of each mapping unit can be determined by referring to the Guide to Mapping Units at the back of this survey. Twenty-one range sites have been identified and described in Uvalde County.

Adobe range site

This range site is made up of undulating, very shallow to shallow, gravelly loams (fig. 21). Permeability is moderately slow to moderate, and the available water capacity is low. This site receives runoff from adjacent, steeper, limestone hills, and runoff is rapid.

About 65 percent of the potential plant community on this site is such grasses as little bluestem, pinhole bluestem, side-oats grama, Nealley grama, and tall dropseed. Other important grasses are tall grama, hairy grama, slim tridens, Lindheimer muhly,

Figure 21. —Area of Brackett and Real soils, undulating, in the Adobe range site. Invading ashe juniper has been controlled.

canyon muhly, seep muhly, perennial three-awn, fall witchgrass, and sedges. Among the woody plants that make up about 10 percent of the plant community are Texas oak, Lacey oak, live oak, evergreen sumac, skunkbush sumac, silktassel, escarpment blackcherry, and Texas madrone. This site also produces such palatable forbs as Mexican sagewort, perennial eveningprimrose, penstemon, bundleflower, gaura, and Engelmanndaisy. Common invader plants are Texas grama, red grama, hairy tridens, puffsheath dropseed, annual grasses, annual weeds, ashe juniper, Texas persimmon, mescal-bean, and agarito.

This site is mostly in fair or poor condition. Although better forage plants respond to deferred grazing and proper use, range recovery may be too slow to be practical unless these practices are accompanied by brush control and range seeding.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 3,500 pounds in wet years to 1,000 pounds in dry years. About 90 percent of this production is from plants that provide forage for cattle and 95 percent for goats.

Clay Flat range site

This range site is made up of nearly level to gently sloping, deep clays that shrink during dry periods and swell during wet periods. When these soils dry, wide, deep cracks form that take in water initially. After they are wet, the cracks close and permeability is very slow. Runoff is mostly slow to medium, and the available water capacity is high.

The soils in this site are droughty and revegetation of desirable plants is difficult after the original grasses have been grazed out.

The climax grasses, those of the potential plant community, are dominantly pink pappusgrass, two-flower trichloris, pinhole bluestem, vine-mesquite, white tridens, and plains bristlegrass. Other important plants on the site, but in lesser amounts, are Arizona cottontop, lovegrass tridens, curly mesquite, tobosa, fall witchgrass, Reverchon panicum, and perennial three-awns.

Invader plants are whorled dropseed, red grama, sand dropseed, and annual weeds. Principal woody plants on this original prairie site are mesquite, Tote-bush, whitebrush, and spiny hackberry. The site does not grow the variety of desirable perennial forbs that some other sites do, but velvet bundleflower is an important legume.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 3,500 pounds in wet years to 1,500 pounds in dry years. Almost all of this production is from plants that provide forage for cattle.

Clay Loam range site

This range site is made up of nearly level to gently sloping, deep soils on uplands. Permeability is slow to moderate, and the available water capacity is high. If vegetative cover is sparse or absent, a crust forms on the surface. Runoff is slow to medium. This site supports a mixture of deep-rooted perennial bunch-grasses and sod grasses.

The potential plant community is climax grasses such as pinhole bluestem, twoflower trichloris, side-oats grama, plains bristlegrass, Arizona cottontop, lovegrass tridens, plains lovegrass, and such forbs as Engelmanndaisy, bushsunflower, and gaura. Vine-mesquite and white tridens grow in low areas. Other important plants are pink pappusgrass, buffalograss, curly mesquite, Texas cristlegrass, tobosa, perennial three-awn, and fall witchgrass. Invader plants are red grama, annual weeds, annual grasses, mesquite, whitebrush, condalia, spiny hackberry, blackbrush, and pricklypear.

This site is mostly in low-fair or poor condition because of continuous heavy grazing by cattle and sheep. Many acres of the site are covered by a dense stand of mesquite and chaparral-type brush.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 3,700 pounds in wet years to 2,000 pounds in dry years. About 95 percent of this production is from plants that provide forage for cattle.

Deep Upland range site

This range site is made up of moderately deep and deep clay loams, clays, and stony clays that are nearly level to gently sloping (fig. 22). Permeability is very slow to moderately slow, and the available water capacity is high. In some places, stones and boulders of varying size are on the surface as well as throughout the soil.

The potential plant community is about 65 percent little bluestem, side-oats grama, and pinhole bluestem. Lesser amounts of indiangrass, Texas cupgrass, plains lovegrass, vine-mesquite, tall dropseed, and forbs grow on the site. Among the forbs are Engelmanndaisy, guara, perennial eveningprimrose, bushsunflower, sensitivebrier, and bundleflower. Other important grasses are Texas wintergrass, buffalograss, curly mesquite, fall witchgrass, hairy dropseed, and meadow dropseed. Scattered mottes of oak can provide as much as 10 percent canopy. Common invader plants are hairy tridens, Texas grama, red grama, three-awn, annual grasses, annual weeds, ashe juniper, Texas persimmon, whitebrush, condalia, mesquite, and Lindheimer senna.

Range recovery is not as rapid on this site as it is on other less clayey sites, but the better forage plants do respond to good management. Brush control, range seeding, rest periods, and proper grazing are needed in some areas to obtain range improvement at a desirable rate.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 4,000 in wet years to 2,000 pounds in dry years. About 95 percent of this production is from plants that provide forage for cattle and for goats.

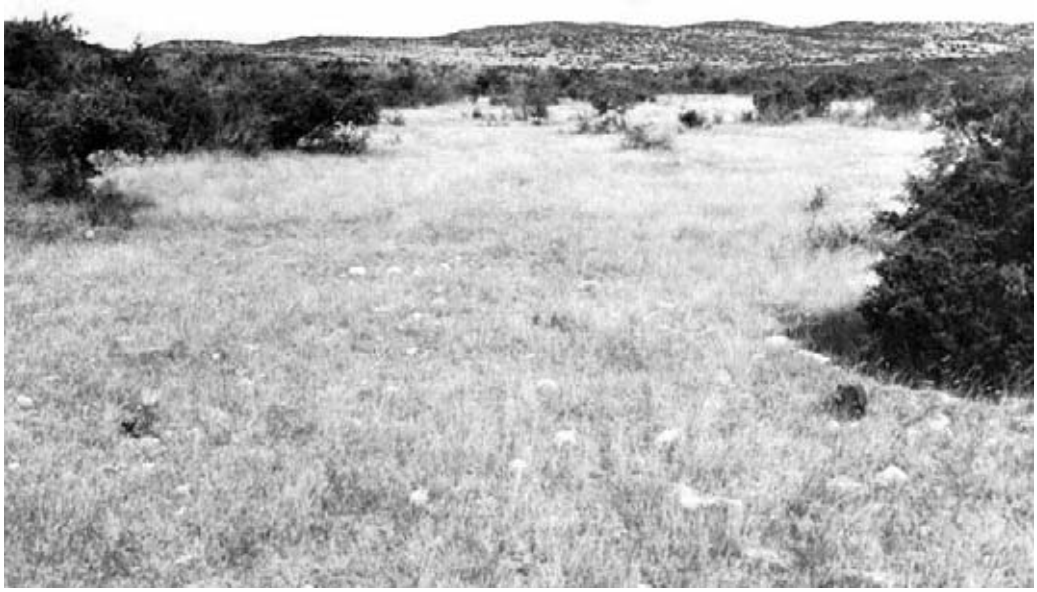

Figure. 22.--Area of a San Saba clay in the Deep Upland range site in a shallow valley below limestone hills. In the background are soils in the Rocky Hill range site.

Gravelly Ridge range site

Hindes and Yologo soils, undulating, are the only soils in this range site. These soils are very shallow to moderately deep, gravelly loams and gravelly sandy clay loams. Permeability is moderately slow to moderate. Runoff is medium to rapid, and the available water capacity is low. The grasses are more widely spaced on this site than on sites that have deeper soils. Plant roots are able to penetrate the underlying caliche layer in places.

The climax plants are pinhole bluestem, side-oats grama, Arizona cottontop, tanglehead, lovegrass tridens, pink pappusgrass, plains lovegrass, Engelmanndaisy, perennial eveningprimrose, gaura, and bushsunflower. Other important plants are Texas bristlegrass, hooded windmillgrass, fall witchgrass, Reverchon panicum, slim tridens, perennial three-awn, and orange zexmenia Climax woody plants such as guajillo and kidneywood make up about 10 percent of the plant cover. Invader plants are red grama, hairy tridens, purple three-awn, annual grasses, annual weeds, ceniza, blackbrush, paloverde, condalia, spiny hackberry, and other woody shrubs.

Although the site is in fair condition in most places, thick stands of guajillo and blackbrush are common.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 2,500 pounds in wet years to 1,500 pounds in dry years. About 60 percent of this production is from plants that provide forage for cattle and 95 percent for goats.

High Lime range site

Atco loam, 0 to 1 percent slopes, and Atco loam, 1 to 3 percent slopes, make up this range site. These soils are deep and nearly level to gently sloping. Permeability is moderate, and the available water capacity is high. Runoff is slow to medium.

About 65 percent of the potential plant community is Arizona cottontop, plains bristlegrass, two-flower trichloris, pinhole bluestem, and lovegrass tridens. Other important grasses are hooded windmillgrass, pink pappusgrass, whiplash pappugrass, Texas bristle-grass, knotroot panicum, Reverchon panicum, sand dropseed, slim tridens, and perennial three-awns. Among the palatable forbs and woody plants are bush-sunflower, orange zexmenia, skeleton goldeneye, kidneywood, and guajillo. Invader plants are red grama, red lovegrass, annual grasses, annual weeds, mesquite, Texas colubrina, condalia, pricklypear, and leatherstem.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 2,500 pounds in wet years to 1,000 pounds in dry years. About 90 percent of this production is from plants that provide forage for cattle.

Igneous Hill range site

This range site is made up of deep to moderately deep, neutral, stony clays. These nearly level to gently sloping and hilly soils are on isolated hills and ridges. They formed in materials weathered from basalt. A few to many fragments of basalt are in the soil and on the surface.

Runoff is rapid, and permeability is slow. The available water capacity is high.

About 70 percent of the potential plant community is grasses such as side-oats grama, pinhole bluestem, plains bristlegrass, green sprangletop, plains lovegrass, and Texas cupgrass. Other important grasses are Texas bristlegrass, fall witchgrass, slim tridens, curly mesquite, purple three-awn, and Wrights three-awn. Palatable woody plants and forbs such as guajillo, kidneywood, bushsunflower, orange zexmenia, bundleflower, and sensitivebrier also grow on the site. Invader plants are red grama, hairy tridens, annual grasses, annual weeds, pricklypear, blackbrush, spiny hackberry, Texas persimmon, whitebrush, and mesquite.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 2,000 pounds in wet years to 1,000 pounds in dry years. About 70 percent of this production is from plants that provide forage for cattle and 90 percent for goats.

Loamy Bottomland range site

This range site is made up of nearly level to gently sloping soils on bottom lands. These are mainly deep soils but some are shallow to gravel. Calcareous fine sandy loams, loams, very gravelly clay loams, and silty clay loams are in this site. Permeability is moderately slow to rapid, and the available water capacity is low to high. These soils receive extra water from flooding. Runoff is slow to medium.

The climax, or potential, vegetation is mainly grasses, but large live oak, pecan, and hackberry trees grow in mottes. The main grasses are fourflower trichloris, Southwestern bristlegrass, big sacaton, little bluestem, pinhole bluestem, Arizona cottontop, big cenchrus, vine-mesquite, white tridens, plains love-grass, Texas cupgrass, Canada wildrye, and side-oats grama. Important forbs are gaura, bundleflower, bush-sunflower, and Engelmanndaisy. Other important plants on the site are buffalograss, curly mesquite, pink pappusgrass, Texas wintergrass, tall dropseed, Texas bristlegrass, and orange zexmenia.

Invader plants are red grama, three-awns, whorled dropseed, hooded windmillgrass, fall witchgrass, annual grasses, annual weeds, large mesquite, whitebrush, retama, spiny hackberry, persimmon, and condalia.

The large trees and brush understory provide cover and food for turkeys, deer, and other wildlife. The abundant wildlife can be maintained if adequate cover, den and roost trees, mast producing trees, and other forage plants are left when brush control or land clearing measures are taken.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 4,800 pounds in wet years to 2,400 pounds in dry years. About 90 percent of this production is from plants that provide forage for cattle and 95 percent for goats.

Low Stony Hill range site

This range site is made up of nearly level to gently sloping and undulating, very shallow to shallow, stony clay. Many limestone fragments are in the soil and on the surface. Permeability is moderately slow. Runoff is rapid, and the available water capacity is low. Small rains are effective, but much water is lost as runoff during heavy rains.

About 50 percent of the plant community is side-oats grama, little bluestem, green sprangletop, pinhole bluestem, Texas cupgrass, and plains lovegrass. Forbs such as bushsunflower, Engelmanndaisy, gaura, bundleflower, prairie clover, perennial eveningprimrose, dalea, penstemon, and prairie acacia make up about 10 percent of the composition. Climax woody plants make up as much as 10 percent of the vegetation and include live oak, kidney wood, skunkbush, Mexican sagewort, black dalea, feather dalea, evergreen sumac, and shin oak. Other important plants that make up about 30 percent of the composition are curly mesquite, buffalograss, fall witchgrass, slim tridens, perennial three-awn, Nealley grama, tall dropseed, meadow dropseed, and orange zexmenia.

Invader plants are Halls panicum, Texas grama, red grama, hairy tridens, tumblegrass, purple three-awn, annual grasses, and annual forbs. Among the woody invaders are juniper, catclaw, persimmon, coyotillo, mescalbean, agarito, and cactus. Live oak often increases to form thick stands.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 3,500 pounds in wet years to 2,000 pounds in dry years. About

90 percent of this production is from plants that provide forage for cattle and 95 percent for goats.

Ramadero range site

Ramadero sandy clay loam is the only soil in this range site. It is nearly level and deep. Permeability is moderate, and runoff is slow. The available water capacity is high. In most places, this range site receives runoff from surrounding areas.

The original vegetation consists of open grassland that contains a high percentage of fourflower trichloris, Arizona cottontop, plains bristlegrass, lovegrass tridens, and big cenchrus. Other important grasses are Nash windmillgrass, buffalograss, and pink pappusgrass. Common invader plants are tumble windmillgrass, whorled dropseed, red lovegrass, three-awn, annual grasses, and annual forbs.

The invasion of dense underbrush and large mesquite trees often results in a nearly impenetrable growth of these woody plants.

This site is an excellent wildlife site. Deer, turkey, javalina, dove, quail, and other kinds of wildlife are abundant.

Where this site is in excellent condition, potential annual per acre yield of air-dry herbage ranges from 5,500 pounds in wet years to 3,000 pounds in dry years. About 90 percent of this production is from plants that provide forage for cattle.

Redland range site

This range site is made up of shallow to moderately deep clay. These nearly level to gently sloping and undulating soils are on benches or in shallow valleys between the steeper limestone hills. Permeability is very slow to slow, and runoff is slow to medium. The available water capacity is low to high.

Plants that make up about 70 percent of the potential plant community are little bluestem, pinhole blue-stem, side-oats grama, and indiangrass. Other important plants on the site, but in lesser amounts, are Texas cupgrass, vine-mesquite, plains lovegrass, tall dropseed, green sprangletop, Texas wintergrass, buffalograss, curly mesquite, meadow dropseed, hairy dropseed, and fall witchgrass.

An open stand of live oak, post oak, blackjack oak, and Texas oak accounts for about 15 percent of the canopy. Palatable forbs on the site are Engelmann-daisy, bundleflower, sensitivebriar, zexmenia, and bushsunflower. Common invader plants are Texas grama, red grama, hairy tridens, purple three-awn, annual grasses, annual weeds, ashe juniper, Texas persimmon, whitebrush, and condalia (fig. 23).

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 4,000 pounds in wet years to 2,000 pounds in dry years. About 90 percent of this production is from plants that provide forage for cattle and goats.

Rocky Hill range site

This range site is made up of Limestone rock land. About 50 to 70 percent of the land surface is steep exposed limestone bedrock. Between these bedrock exposures are very shallow clay loam soils covered with limestone pebbles, cobbles, stones, and boulders. Spots of deeper soil are found in pockets and in crevices in the limestone bedrock. Rainfall runoff from the exposed rocks saturates the very shallow soil and the soil-filled crevices. This additional runoff makes small rains very effective. Rapid runoff after heavy rains causes erosion of areas not covered by vegetation or rock mulch.

The plant community consists of little bluestem, side-oats grama, Nealley grama, pinhole bluestem, green spangletop, plains lovegrass, and Texas cup-grass. Other important grasses on this site are fall witchgrass, slim tridens, Texas winter grass, and hairy grama. Perennial forbs such as orange zexmenia, gaura, bundleflower,

Figure 23.—Vegetation on Topia clay in the Redland range site.

Engelmanndaisy, and bushsunflower make up about 10 percent of the annual herbage production.

Invader plants are red grama, Texas grama, purple three-awn, hairy tridens, annual grasses, and annual forbs. Invading woody plants are juniper, persimmon, mescalbean, coyotillo, catclaw, agarito, and pricklypear.

The steep, rocky terrain in this site limits grazing mainly to goats, but sheep graze on the more gentle slopes.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 2,000 pounds in wet years to 1,200 pounds in dry years. About 85 percent of this production is from plants that provide forage for cattle and 95 percent for goats.

Sandy Loam range site

This range site is made up of nearly level to gently sloping, deep fine sandy barns to fine sands on uplands. Permeability is moderate to moderately rapid, and runoff is slow to medium. The available water capacity is low to moderate.

About 65 percent of the potential plant community is tanglehead, Arizona cottontop, twoflower trichloris, pinhole bluestem, lovegrass tridens, and plains bristlegrass. Other important grasses are pink pappusgrass, whiplash pappusgrass, Texas bristlegrass, hooded windmillgrass, sand paspalum, Reverchon panicum, knotroot panicum, sand dropseed, and perennial three-awns. The site supports several palatable forbs such as bushsunflower, orange zexmenia, and gaura.

Invader plants are red lovegrass, gummy lovegrass, fringed signalgrass, red grama, tumblegrass, sandbur, numerous annual weeds, mesquite, blackbrush, condalia, leatherstem, spiny hackberry, Texas colubrina, and pricklypear.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 3,500 pounds in wet years to 2,000 pounds in dry years. About 90 percent of this production is from plants that provide forage for cattle.

Shallow range site of the Edwards Plateau

This range site is made up of nearly level to gently sloping, shallow clays that overlie limestone in the Edwards Plateau. Permeability is moderately slow. Run-off is slow, and the available water capacity is low. Some runoff is received from surrounding areas of steeper limestone hills.

About 60 percent of the potential plant community is grasses such as little bluestem and side-oats grama. Pinhole bluestem, Texas cupgrass, plains lovegrass, vine-mesquite, and climax forbs grow in lesser amounts. Other important grasses are curly mesquite, buffalograss, Texas wintergrass, fall witchgrass, slim tridens, and perennial three-awns. An open stand of oak grows on this site in the potential plant community, and it makes about 10 percent crown canopy.

Invader plants are Halls panicum, red grama, hairy tridens, annual grasses, annual weeds, cedar, Texas persimmon, agarito, mesquite, and catclaw.

Brush control patterns, kinds of domestic animals grazing on the site, and the degree of use of forage plants influence kinds and numbers of birds and animals on this site. Wise use of these factors can greatly increase wildlife on the site.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 3,500 pounds in wet years to 2,000 pounds in dry years. About 95 percent of this production is from plants that provide forage for cattle and goats.

Shallow range site of the Rio Grande Plain

This range site is made up of nearly level to gently sloping and undulating, shallow to deep clay loams and gravelly clay loams in the Rio Grande Plain. Permeability of the soils is moderate, and runoff is slow to medium. The available water capacity is low to moderate.

About 60 percent of the climax plant community is grasses such as side-oats grama, Arizona cottontop, pink pappusgrass, pinhole bluestem, and climax forbs. Other important grasses are bristlegrass, buffalograss, curly mesquite, slim tridens, and perennial three-awn. Guajillo, kidneywood, and ephedra are woody increasers on the site and make up 5 to 10 percent of the climax plant community. Common invader plants are red grama, hairy tridens, Halls panicum, annual grasses, annual weeds, mesquite, leatherstem, blackbrush, catclaw, spiny hackberry, agarito, cactus, and lotebush.

The site produces many plants useful for deer, javalina, and quail. These game animals and birds should be given proper consideration in brush control and seeding operations.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 2,000 pounds in wet years to 1,000 pounds in dry years. About 90 percent of this production is from plants that provide forage for cattle and 95 percent for goats.

Shallow Ridge range site

This range site is made up of undulating and gently sloping to sloping, very shallow to shallow loams and gravelly loams. Permeability is moderate. Runoff is medium, and the available water capacity is low.

Grasses such as side-oats grama and Arizona cottontop make up more than 50 percent of the potential plant community. Also present, but in lesser amounts, are green sprangletop tanglehead, pinhole bluestem, and lovegrass tridens. Woody plants and forbs, such as kidneywood, guajillo, feather dalea, ephedra, bush-sunflower, and orange zexmenia, make up 10 to 15 percent of the potential plant community. Other important grasses on the site are Texas bristlegrass, slim tridens, fall witchgrass, Reverchon panicum, and perennial three-awns. Common invader

plants are red grama, hairy tridens, annual grasses, annual weeds, blackbrush, ceniza, pricklypear, leatherstem, catclaw, condalia, and mesquite.

In addition to providing good cover, many of the plants on this site are choice forage plants for deer. Many ranchers leave this site undisturbed as game habitat.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 1,800 pounds in wet years to 900 pounds in dry years. About 90 percent of this production is from plants that provide forage for cattle and 95 for goats.

Shallow Sandy Loam range site

Randado fine sandy loam, 1 to 3 percent slopes, is the only soil in this range site. This gently sloping soil is shallow and tends to be droughty. Permeability is moderate, runoff is medium, and the available water capacity is low. Small rains are effective.

The climax vegetation on this site is mid grasses, which make up approximately 60 percent of the composition. Among these grasses are side-oats grama, pinhole bluestem, fourflower trichloris, and Arizona cottontop. Other important grasses are hooded windmillgrass, Nash windmillgrass, pink pappusgrass, and perennial three-awns. Palatable forbs on this site are bushsunflower, orange zexmenia, calliandra, and several perennial legumes. Invader plants are red love-grass, red grama, purple three-awn, annual grasses, and annual forbs. Invading woody plants are black-brush, mesquite, spiny hackberry, condalia, and leatherstem.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 2,500 pounds in wet years to 1,000 pounds in dry years. About 80 percent of this production is from plants that provide forage for cattle and 95 percent for goats.

Steep Adobe range site

This range site is made up of hilly to steep, shallow to very shallow, gravelly loams and gravelly clay loams. Permeability is moderate to moderately slow. Runoff is rapid, and the available water capacity is low. This site receives extra water as runoff from the limestone outcrops and a good cover of vegetation is needed to help control erosion.

About 60 percent of the potential plant community is grasses such as little bluestem, pinhole bluestem, side-oats grama, Nealley grama, Lindheimer muhly, tall dropseed, and hairy dropseed. Other important plants are tall grama, hairy grama, perennial three-awn, slim tridens, seep muhly, canyon muhly, and sedges. Woody plants that make up about 15 percent of the plant community are Texas oak, Lacey oak, live oak, evergreen sumac, skunkbrush sumac, Lindheimer silktassel, escarpment blackcherry, and Texas madrone. Palatable forbs such as Mexican sagewort, perennial eveningprimrose, penstemon, and bundleflower also grow on this site. Common invader plants are Texas grama, red grama, hairy tridens, annual three-awn, ashe juniper, mescalbean, Texas persimmon, and agarito.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 2,500 pounds in wet years to 1,000 pounds in dry years. About 85 percent of this production is from plants that provide forage for cattle and 90 percent for goats.

Steep Rocky range site

This range site is made up of the Rock land part of the Rock land-Real association. Areas are mainly sloping to steep and of exposed limestone bedrock. Between these limestone bedrock exposures are shallow to very shallow clay learns covered with pebbles, cobbles, stones, and boulders. Water from small showers runs

off the boulders and limestone exposures and enters the soil-filled pockets and crevices. Rapid runoff from heavy rains is common on this site.

More than one-half of the potential plant community is little bluestem, side-oats grama, Nealley grama, pinhole bluestem, green sprangletop, Texas cupgrass, tall dropseed, plains lovegrass, tall grama, hairy grama, fall witchgrass, Texas wintergrass, slim tridens, buffalograss, curly mesquite, forbs, and woody plants.

Climax perennial forbs that make up about 10 percent of the annual herbage production are Mexican sagewort, Engelmanndaisy, bushsunflower, orange zexmenia, gaura, penstemon, bundleflower, and perennial eveningprimrose.

Climax woody plants make up as much as 20 percent of the plant community. Some of these are live oak, Lacey oak, Texas oak, shin oak, kidneywood, skeleton goldeneye, skunkbush, evergreen sumac, ephedra, feather dalea, and black dalea.

Invaders are grasses, forbs, and woody plants. Among these are red grama, Texas grama, hairy tridens, purple three-awn, annual grasses, annual weeds, juniper, persimmon, mescalbean, coyotillo, catclaw, agarito, and cactus. Ashe juniper has invaded large areas.

This site is grazed mostly by goats, sheep, and deer. The site does not lend itself to mechanical brush control. Forage plants, however, do respond to deferred grazing and proper stocking rates.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 2,000 pounds in wet years to 1,000 pounds in dry years. About 85 percent of this production is from plants that provide forage for cattle and 95 percent for goats.

Stony Ridge range site

This range site consists of undulating to hilly, very shallow to shallow stony clay learns, Many limestone fragments are in the soil and on the surface, and boulders and stones up to several feet in diameter crop out in many places. Permeability is moderate, and the available water capacity is low. Water from small rains enters the soil, but runoff from heavy rains is rapid. Soil erosion is active where the vegetation is sparse. Overgrazed areas recover rapidly if rested and grazed properly because rocks on the surface protect some of the better plants by preserving a seed source.

Short and mid grasses and a variety of perennial forbs and woody plants make up the climax plant community. About 55 percent vegetation is side-oats grama, pinhole bluestem, green sprangletop, plains lovegrass, Texas cupgrass, and Texas wintergrass. Other important grasses are fall witchgrass, curly mesquite, slim tridens, hairy grama, Reverchon panicum, Texas bristlegrass, and perennial three-awns. Perennial forbs in the climax vegetation are Engelmanndaisy, gaura, perennial eveningprimrose, bushsunflower, orange zexmania, bundleflower, prairie acacia, and dalea. The woody plants are guajillo, kidneywood, vine ephedra, manystem ratany, false mesquite, Southwest bernardia, and Texas bauhinia.

Invader plants are red grama, Halls panicum, hairy tridens, purple three-awn, annual forbs, and annual grasses. Woody plants such as persimmon, catclaw, blackbrush, whitebrush, coyotillo, leatherstem, and cactus also invade this site (fig.24).

Because grazing by goats and sheep has been heavy, most of the acreage in the site is in fair or poor condition. Much of the site is covered with thick stands of blackbrush, guajillo, leatherstem, pricklypear, and mixed brush.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 2,000 pounds in wet years to 1,000 pounds in dry years. About 90 percent of this production is from plants that provide forage for cattle and 95 percent for goats.

Figure 24.—Area of Ector soils in the Stony Ridge range site. The dominant woody vegetation is blackbrush and leatherstem.

Tight Sandy Loam range site

Webb fine sandy loam, 0 to 1 percent slopes, and Webb fine sandy loam, 1 to 3 percent slopes, make up this range site. These soils are nearly level to gently sloping. Permeability is moderately slow, and runoff is slow to medium. The available water capacity is high.

About 60 percent of the climax plant community is grasses such as side-oats grama, pinhole bluestem, and Arizona cottontop. Other important grasses are pink pappusgrass, Texas bristlegrass, hooded windmill-grass, and perennial three-awns. Common invader plants are red grama, red lovegrass, Texas grama, annual grasses, and annual forbs. Woody invader plants are mesquite, blackbush in dense stands, spiny hack-berry, and condalia.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 3,000 pounds in wet years to 1,500 pounds in dry years. About 90 percent of this production is from plants that provide forage for cattle.

Use of the Soils for Wildlife

By James Henson, field specialist in biology, Soil Conservation Service, and Clifford Carter, field specialist in range, Soil Conservation Service.

In Uvalde County, the main kinds of wildlife are whitetail deer, turkey, javelina, fox squirrel, bobwhite quail, scaled (blue) quail, dove, cottontail rabbit, jackrabbit, and numerous kinds of nongame birds. Such exotic game animals as mouflon sheep, axis deer, and Russian boar have been introduced to the county. Other kinds of wildlife are raccoon, fox, ringtail cat, skunk, opossum, beaver, and other furbearers. Common predators are bobcats, coyote, and a few mountain lions. Intermittent lakes, streams, ponds, and grain fields attract duck and geese during migration. Most farm and ranch ponds are stocked with channel catfish, black bass, and subfish. The perennial streams afford good fishing. Commercial production of catfish has been started in the county. Fish and wildlife resources are of great economic importance to landowners in this county.

Successful management of wildlife on any tract of land requires that food, cover, and water be available in a suitable combination. Lack of any one of these, an unfavorable balance among them, or an inadequate distribution of them can severely

limit or account for the absence of a desired kind of wildlife. Soil information provides a valuable tool in creating, improving, or maintaining suitable food, cover, and water for wildlife.

Most wildlife habitats are created or managed by planting suitable vegetation, by manipulating existing vegetation so as to bring about natural establishment, increase or improvement of desired plants, or by a combination of such measures. The influence of a soil on plant growth is known for many kinds of soils and can be inferred for others from a knowledge of the characteristics and behavior of the soil. In addition, soil information is useful in selecting sites for creating or improving water areas for wildlife habitats.

Soil interpretations for wildlife habitat aid in selecting the more suitable sites for specific animals or birds, and they serve as indicators of the level of management intensity needed to achieve satisfactory results. They also serve as a means of showing why it may not be generally feasible to manage a particular area for a given kind of wildlife. These interpretations can be used for broad-scale planning of wildlife management areas, parks, and nature areas, or for acquiring wildlife lands. They also can be important where wildlife is a secondary use, for example, on range.

Soil properties that affect wildlife habitat are: (1) thickness of soil useful to crops, (2) texture of surface layer, (3) available water capacity to a depth of 40 inches, (4) wetness, (5) surface stoniness or rockiness, (6) flooding hazard, (7) slope, (8) climate, and (9) salinity.

The soil areas shown on the soil survey maps are rated without regard to positional relationships with adjoining delineated areas. The size, shape, or location of the outlined area does not affect the rating. Certain influences on habitats such as elevation and aspect must be appraised on site.

In table 3, the soils of Uvalde County are rated for the creation, improvement, or maintenance of six wildlife habitat elements. These ratings are based upon limitations imposed by the characteristics or behavior of the soil. Four levels of suitability, which indicate the degree of soil suitability for a given habitat element, are recognized.

Suitability of the soils for wildlife

The following definitions are given for habitat suitability ratings used in table 3:

Well suited indicates that habitats generally are easily created, improved, or maintained; that the soil has few or no limitations that affect management; and that satisfactory results can be expected.

Suited indicates that habitats can be created, improved, or maintained in most places; that the soil has moderate limitations that affect management; and that moderate intensity of management and fairly frequent attention may be required for satisfactory results.

Poorly suited indicates that habitats can be created, improved, or maintained in most places; that the soil has rather severe limitations; that habitat management is difficult and expensive and requires intensive effort; and that results are not always satisfactory. (For short-term usage, soils rated as “poorly suited” may provide easy establishment and temporary values).

Unsuited indicates that the soil limitation is so extreme that it is impractical, if not impossible, to manage the designated habitat element. Unsatisfactory results are probable.

Elements of Wildlife habitat

The six habitat elements rated in table 3 are defined and exemplified as follows:

Grain and seed crops are agricultural grains or seed-producing annuals planted to produce food for wildlife. Examples are corn, sorghums, wheat, oats, and sunflower.

Grasses and legumes include domestic perennial grasses and legumes that are established by planting and which furnish food and cover for wildlife. Examples are blue panicum and kleingrass. Among the legumes are clovers and annual lespedezas.

Wild herbaceous upland plants are perennial grasses and forbs that provide food and cover for wildlife. Examples of these are bluestem, panicum, side-oats grama, wild bean, Engelmanndaisy, Mexican sagewort, bushsunflower, and dalea.

Hardwood trees and shrubs are nonconiferous trees, shrubs, and woody vines that produce fruits, nuts, buds, catkins, or foliage (browse) used extensively as food by wildlife. These plants commonly become established through natural processes, but they may be planted. Examples are oak, pecan, mesquite, hackberry, whitebrush, kidneywood, catclaw, acacia, wild cherry, wild grape, honeysuckle, greenbrier, and autumn olive.

Wetland food and cover plants are annual and perennial, wild, herbaceous plants in moist to wet sites, exclusive of submerged or floating aquatics, that produce food or cover that is extensively and dominantly used by wetland forms of wildlife. Examples are smartweed, wild millet, bulrush, spike sedge, rushes, sedges, burreeds, wild rice cutgrass, sourdock, and cattails.

Shallow-water developments are low dikes and water-control structures established to create habitat principally for waterfowl. They may be designed so that they can be drained, planted, and flooded, or they may be used as permanent impoundments to grow submerged aquatics. Both fresh and brackish water impoundments are included.

Kinds of wildlife

The three general kinds of wildlife are defined as follows:

Open land wildlife is birds and mammals that normally frequent cropland, pastures, range, and areas overgrown with grasses, herbs, and shrubby growth. Examples of this kind of wildlife are quail, dove, cottontail rabbit, jackrabbit, and sand hill crane.

Brushland wildlife is birds and mammals that normally frequent wooded areas of hardwood trees and shrubs. Examples of brushland wildlife are deer, turkey, javelina, squirrel, raccoon, and coyote.

Wetland wildlife is birds and mammals that normally frequent such areas as ponds, streams, ditches, marshes, and swamps. Examples of this kind of wildlife are duck, geese, and beaver.

Use of the Soils in Engineering

By Joseph G. Miller, civil engineer, Soil Conservation Service.

This section provides information of special interest to engineers, contractors, farmers, and others who use soil as structural material or as foundation material upon which structures are built. Information is given in this section about those properties of the soil that affect construction and maintenance of roads, airports, pipelines, water storage facilities, erosion control structures, and drainage systems. Among the properties most important in engineering are permeability, compressibility, shear strength, compaction characteristics, drainage, shrink-swell potential, grain-size distribution, plasticity, and reaction. Also important are the depth to bedrock.

Information concerning these and related soil properties is given in tables 4, 5, 6, and 7. The estimates and interpretations of soil properties in these tables can be used to—

1. Make soil and land use studies that aid in selecting and developing sites for industrial, business, residential, and recreational uses.
2. Locate probable sources of sand and other material for construction.

3. Make preliminary estimates of the engineering properties of soils for use in planning the construction of terraces, ponds, irrigation systems, and other structures for soil and water conservation.
4. Correlate performance of engineering structures with soil mapping units.
5. Determine the suitability of soils for the cross-country movement of vehicles and construction equipment.
6. Obtain supplemental information from other published maps, reports, and aerial photo-graphs for the purpose of making maps and reports that can be used readily by engineers.
7. Develop other preliminary estimates for construction purposes pertinent to the particular area.

This survey does not eliminate the need for or take the place of onsite sampling and testing of soils for the design and construction of specific engineering works. The estimated values for bearing capacity and traffic supporting capacity expressed in words should not be assigned specific values.

This survey can be useful in planning more detailed field surveys to determine the inplace condition of the soil at the site. Estimated engineering properties are generally to depths of about 5 feet, and interpretations normally do not apply to greater depths. In addition, small areas of other soils and contrasting situations are included in mapping units that may have different engineering properties than those listed.

Some of the special terms used by soil scientists may not be familiar to the engineer, and some common terms may have special meanings in soil science. Several of these terms are defined in the Glossary. Additional information about the soils can be found in other sections of this survey.

Winter grading and frost action are not problems in Uvalde County because the soils generally have a low moisture content during winter, and periods of subfreezing temperatures are fairly short. In addition, agricultural drainage and salinity are not problems in this county. Some of the Montell soils are moderately to highly saline, and some of the Mercedes soils are moderately saline.

Open-quarry mining of rock asphalt and traprock is done in Uvalde County. Rock asphalt seams are in the interbedded limestone beneath the Ector soils in the southwestern part of the county. The traprock is quarried in the area west of Knippa from beneath the Ingram soils.

Engineering classification systems

The material in the horizons of a typical profile for each soil type is classified, in table 4, according to the following three most commonly used systems: the USDA system; the Unified soil classification system used by the engineers of the Soil Conservation Service, the Department of Defense, the U.S. Army Corps of Engineers, and others (7); and the AASHO system, adopted by the American Association of State Highway Officials (1).

Agricultural scientists of the United States Department of Agriculture classify soils according to texture, color, and structure. This system is useful as the initial step in making engineering classifications of soils. Additional properties important in engineering can be estimated or can be determined by tests.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. “Sand,” “silt,” “clay,” and some of the other terms used in the USDA textural classification are defined in the glossary of this survey.

In the Unified Soil Classification System, soils are classified according to particle size distribution, plasticity index, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils. identified as GW, GP,

GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example CH-MH. The letters used in class designation mean G, gravel; S, sand; M, silt; and C, clay. Clean sands are identified by SW or SP; sands with fines of silt and clay by SM or SC; silt and clay that have a low liquid limit by ML and CL; and silt and clay that have a high liquid limit by MH and CH.

Most highway engineers classify soil material according to the AASHO system. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme are clay soils that have low strength when wet. The best soils for subgrade are therefore classified as A-1, the next best A-2, and so on to class A-7, the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. If soil material is near a classification boundary, it is given a symbol showing both classes; for example, A-4 or A-6. Within each group, the relative engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. The AASHO classification for tested soils, with index numbers in parentheses, are shown in table 7; the estimated classifications for all soils mapped in the survey are given in table 4.

Engineering properties of the soils

Table 4 provides estimates of soil properties that apply to engineering. These estimates are based on the test data shown in Table 7, on field tests, and on experience with the same kinds of sons in surrounding counties.

In the column “Depth to Bedrock,” depth is shown in inches to where consolidated material is found.

Classification according to hydrologic soil groups is used in watershed planning to estimate runoff from rainfall. Soil properties that influence the minimum rate of infiltration obtained for a soil unprotected by vegetation and after prolonged wetting are considered. These properties are depth of seasonally high water table, intake rate and permeability after prolonged wetting, and depth to very slowly permeable layer. The influence of ground cover is treated independent of the hydrologic soil groups. The soils in Uvalde County have been classified into four groups, A through D.

Group A soils have a high infiltration rate even when thoroughly wetted. These are chiefly deep, well-drained to excessively drained sand, gravel, or both, These soils have a high rate of water transmission and a low runoff potential.

Group B soils have a moderate infiltration rate when thoroughly wetted. These are chiefly moderately deep to deep, moderately well drained to well-drained soils that have moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission and a moderate runoff potential.

Group C soils have a slow infiltration rate when thoroughly wetted. These are chiefly soils that have a layer that impedes downward movement of water, soils that have moderately fine to fine texture and slow infiltration rate, or soils that have moderate water tables. These soils have a slow rate of water transmission and a high runoff potential.

Group D soils have a very slow infiltration rate when thoroughly wetted. These are chiefly clay soils that have high swelling potential. soils that have a permanent high water table, soils that have a claypan or clay laver at or near the surface, and shallow soils that overlie nearly impervious material. These soils have a very slow rate of water transmission and a very high runoff potential.

In the column headed ‘’Depth from surface,’’ the depth, in inches. is given for the major distinctive layers of the soil profile.

In the columns headed “Coarse fraction greater than 3 inches (percent)” and “Percentage less than 3 inches passing sieve,” estimates are given for a range in percentage of soil materials passing five different sieve sizes. This information is useful in helping to determine suitability of the soil as material for construction purposes.

Permeability, as used in table 4, relates only to movement of water downward through undisturbed and uncompacted soil. It does not include lateral seepage. The estimates are based on structure and porosity of the soil. Plowpans, surface crusts, and other properties resulting from use of the soils are not considered.

Available water capacity is the amount of water a soil can hold and make available to plants. It is the numerical difference between the percentage of water at field capacity and the percentage of water at the time plants wilt. The rate is expressed as inches of water per inch of soil depth.

Reaction is the degree of acidity or alkalinity of a soil expressed as a pH value. Soil reaction and relative terms used to describe pH values are explained in the Glossary.

Shrink-swell potential is an indication of the volume changes to be expected of the soil material that accompany changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or with such material.

Specific ratings for corrosivity of soils were not included in table 4 because most soils in Uvalde County have a high corrosivity potential for uncoated metal pipe and low corrosivity potential for concrete.

Corrosivity indicates the hazard to structural materials, such as metal or concrete pipe, that corrode when buried in soil. Any given material corrodes in some soils more rapidly than in others; therefore, soil corrosivity differs with the general character of the soil. To be meaningful, a corrosivity rating must be given in relation to a specific structural material in a specific kind of soil.

Corrosion of uncoated steel pipe is a physical-biochemical process converting iron into its ion. Soil moisture forms solutions with soluble salts to create a corrosion cell. The operation of the corrosion cell is influenced by soil moisture content, conductivity of soil solution, reaction, aeration, and activity of organisms capable of causing oxidation-reduction reactions. The corrosivity of soil for untreated steel pipe is commonly determined by measuring electrical resistivity or resistance to flow of current, total acidity, soil drainage, and soil texture.

Most soils in Uvalde County have a high corrosivity potential for uncoated steel pipe. The Comitas sandy subsoil variant has a low corrosivity potential. Dev, Orif, and Randado soils have a moderate potential.

Concrete placed in soil materials is also subject to decay. Special cements and methods of manufacturing reduce rate of deterioration in soils of high corrosivity. The rate of deterioration depends on soil texture and soil acidity, the amount of sodium or magnesium sulfate present in the soil singly or in combination, and the amount of sodium chloride in the soil.

Most soils in Uvalde County have a low corrosivity potential for concrete. Comitas sandy subsoil variant is moderately corrosive to concrete because of total acidity, and Montell clay is moderately corrosive because of salinity.

A column for seasonal high water table was not included in table 4 because it is not generally an engineering problem in this county.

Engineering interpretations of the soils

Tables 5 and 6 indicate the degree of limitation and the soil features that adversely affect specified engineering uses for farming and for recreation and for use in town and country planning.

Features generally favorable means that the soils have properties favorable for the specified use. A slight limitation is one so minor that it can be easily overcome. Good performance and low maintenance can be expected from these soils.

Moderate means soils have properties moderately favorable for the specified use. Limitations can be overcome or modified with planning, design, or special maintenance. Some of these limitations can be tolerated.

Severe means soils have one or more properties unfavorable for the rated use. Limitations are difficult and costly to modify or overcome, requiring major soil reclamation, special design, or intense maintenance.

Use of the Soils for Recreation

Many areas of Uvalde County have a medium to high potential for the development of various types of recreational enterprises. The county has scenic, natural, and historical areas that are of interest to the outdoor recreationist. The Nueces, Frio, Leona, and Sabinal Rivers offer a high potential for the development of water-based recreation.

Table 5 can be used as a general guide in selecting sites for recreational activities. This table gives the degree and kind of limitation of each soil in the county for use as camp areas, picnic areas, playgrounds, and paths and trails. Limitations are based on soil characteristics. Such esthetic factors as kind and number of trees or the presence of water that affect the desirability of a site were not considered. Some soils that have severe limitations are in scenic locations, but these soils require extensive preparation and maintenance. Other soils that have slight or no limitations are covered with noxious weeds or lack shade trees, grass plantings, or water developments.

Important soil properties that affect the use for recreational developments are wetness, flooding, slope, permeability, texture of soil surface, coarse fragments on surface, stoniness, and rockiness.

Camp areas are those areas used intensively for tents and small camp trailers and the accompanying outdoor activities. Little site preparation other than shaping and leveling for tent and parking areas is normally required. These areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have gentle slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface texture that is firm even after rains but not duty when dry.

Picnic areas are those areas that are subject to heavy foot traffic, but most vehicular traffic is confined to access roads. Preparation of an area consists of leveling sites for tables and fire places and the building of access roads. Preparation of an area consists of leveling sites for tables and fireplaces and the building of access roads. Freedom from dustiness and muddiness are major requirements for site selection. Strong slopes and rockiness greatly increase the cost of leveling the site and building access roads.

Playgrounds are those areas that are used intensively for play, such as baseball, football, volleyball, badminton, and other organized games. These areas are subject to intensive foot traffic. The best soils for playgrounds have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during period of heavy use, and a surface texture that is firm even after rains and is not dusty when dry. Depth to rock is and important consideration on uneven slopes that require grading and leveling.

Paths and trails are areas suited to use as local and cross-country footpaths and trails and for bridle paths. It is assumed that these areas will be used as they occur in nature and that little or no soil will be moved (excavated or filled). Soil features that affect trafficability, dust, and the design and maintenance of trafficways are given special emphasis in this evaluation.

Use of the Soils for Farming

Table 5 gives interpretations of soil properties for farming and recreational use. The columns headed Camp areas, Picnic areas, Playgrounds, and Paths and Trails are discussed in the section ''Use of Soils for Recreation.'' The remaining columns are discussed here.

Pond reservoirs are areas behind a dam or embankment where water is collected and stored for use. The floor of the reservoir area is normally undisturbed except where soil material may be borrowed for embankment construction. Properties affecting pond reservoir areas are those that affect seepage rates, namely permeability and depth to fractured bedrock or to other permeable material.

Pond embankments are raised structures of soil material constructed across drainageways in order to impound water. The soil properties that are considered in their construction are those that affect the embankment and the availability of borrow material. The best soils have good slope stability, low permeability, slight compressibility under load, and good resistance to piping and erosion. The best borrow material is free of stones or rock and is thick enough for easy excavation.

The suitability of soils for *irrigation* depends largely on intake rate, the available water capacity, depth and slope of soil, susceptibility to water erosion, and susceptibility to flooding.

Soil features that affect the suitability of a soil for *terraces and diversions* are texture, slope, depth to unfavorable material, and stability. Field terraces constructed on erodible, sandy soils are difficult to build and maintain.

Grassed waterways are constructed to carry off excess water that is discharged from terraces, diversions, and other areas. Shallowness to bedrock or other unsuitable material adversely affects the construction of waterways because soils tend to be droughty and vegetation is difficult to establish and maintain

Use of the Soils for Town and Country Planning

The nonfarm uses of lands of Uvalde County are increasing. To help planners, builders, and maintenance men avoid costly land preparations, maintenance, or even failure, the soils of Uvalde County are rated as to their suitability as a source of topsoil, sand and gravel, and road fill. The degree of limitation of the soils and the features adversely affecting roads and streets, low building foundations, light industries, and sewage disposal facilities are listed in table 6.

Topsoil is a term used to designate a fertile soil or soil material, ordinarily rich in organic matter, used as topdressing for roadbanks, dams, disturbed areas, gardens, lawns, and the like. Normally only the surface layer is used, but other layers may also be suitable. Excess lime refers to the calcium carbonate equivalent of a soil. The percentage calcium carbonate equivalent is given in the range of characteristics for these soils where this characteristic is important. A calcium carbonate equivalent greater than about 15 percent will cause chlorosis, loss of iron characterized by blanching, in some plants. The chlorosis can be controlled with the application of iron supplements and large amounts of organic residues. A calcium carbonate equivalent that exceeds about 30 percent is impractical to correct for use as topsoil.

Most of the soils in the county are not suited or are a poor source of sand and gravel. Some gravels are in areas of Dev or Orif soils. Areas of Orif soils are also a source of sand.

Roadfill is soil material used to build up road grades for supporting base layers. The suitability for road fill depends largely on its texture, plasticity, shrink-swell potential, traffic supporting capacity, inherent erodibility, compaction characteristics, and natural water content.

Roads and streets are trafficways that consist of the underlying local soil material, either cut or fill, called the subgrade, the stabilizing subbase soil material of gravel, crushed rock, or lime—a kind of soil cement, and the actual road surface or pavement. Roads usually are constructed with thicker or higher duality subbase than streets and are generally designed with more gradual grade. However, the requirements for subgrade and excavation are similar. Properties of the soils that affect design and construction of roads and streets are (1) those that affect traffic supporting capacity and stability of subgrade and (2) those that affect the ease of excavation and the amount of cut and fill.

In evaluating and rating soils for building foundations and light industry, the most important factors are slope, depth, flooding hazard, shrink-swell potential, and corrosion potential. The interpretations relate to buildings that are not more than three stories high.

In rating soils for sewage disposal systems, the degree of limitations for septic tank filter fields and sewage lagoons is based on the soil features that determine capacity to absorb effluent. These soil features are permeability, flooding hazard, slope, and depth to rock or other impervious material.

Engineering test data

Table 7 shows the results of engineering tests performed by the Texas Highway Department on eight samples from three series in Uvalde County. The table shows the specific locations where the samples were taken, the parent material, the depth to which the sampling was done, and the results of tests to determine particle-size distribution and other properties significant in soil engineering.

Parent material is the disintegrated and partly weathered rock from which the soil has formed.

Depth from surface indicates the depth and thickness of the layers for which tests were made. The thickness of the layers varies somewhat from place to place, but the thickness and other properties described are those actually obtained in a specific profile of the soil described.

Shrinkage limit is a measurement of the moisture content at which shrinkage stops. As moisture leaves a soil, the soil decreases in volume in proportion to the loss in moisture, until a point is reached where shrinkage stops even though additional moisture is removed. The shrinkage limit of the soil is a general indication of the clay content; it decreases as clay content increases. In sand that contains little or no clay, the shrinkage limit is close to the liquid limit and is considered insignificant.

The shrinkage ratio is the volume change resulting from the drying of a soil material, divided by the loss of moisture caused by drying. The ration is expressed numerically. The volume change used in computing shrinkage ratio is the change in volume that takes place in a soil when it dries from a given moisture content to a point where no further shrinkage takes place.

Lineal shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from an original, pre-drying percentage to the shrinkage limit.

Mechanical analysis shows the percentage, by weight, of soil particles passing through sieves of specified sizes. Gravel ranges from 3 inches in diameter to slightly more than 2 millimeters, the size of the No. 10 sieve. Sand and other granular material are retained in the No. 200 sieve, but finer particles such as silt and clay pass through the openings. The soil material intermediate in size between 0.002

millimeter and that held in a No. 200 sieve is silt. Clay is the soil material fraction smaller than 0.002 millimeter in diameter.

The tests for liquid limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The liquid limit is the moisture content at which the material passes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a semisolid to a plastic state.

The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

Geology

In order to better understand the factors of soil formation, especially parent material and relief, it is best to study the types of terrain and the surface geology characteristic of Uvalde County. The northern half of the county is a part of the Edwards Plateau, which in turn is a part of the Great Plain. The southern half is a part of the Rio Grande Plain, which is a part of the Gulf Coastal Plain. These physiographic divisions are separated by a moderately low escarpment known as the Balcones escarpment, or Balcones fault zone.

The Edwards Plateau is mainly underlain by hard limestone, which is highly resistant to erosion. A lesser part of the Edwards Plateau is underlain by more easily erodible soft limestone, marl, and shale. The plateau has an altitude ranging from about 1,100 to 2,000 feet. Numerous streams and their tributaries have formed ridges, hills, and deep, narrow valleys and have cut canyons as deep as 500 feet that dissect the plateau. The terrain is rough, and the soils are thin.

Most of the Rio Grande Plain is underlain by soft limestones and marls. The plain is mostly nearly level to gently sloping or undulating hills, except for the several igneous hills that rise sharply above it. Hills of this kind are Blue, Inge, Black, Ingram, and Asphalt Mountains. They rise 200 to 400 feet above the plains. In the southwestern part of the county, the Anacacho Mountains, about 100 to 250 feet above the plain, is of resistant limestone. The altitude of the plain ranges from about 700 to 1,000 feet. The soils are thin on the ridges and thick on the plains and valleys.

The surface geology of Uvalde County consists of sedimentary and igneous rocks. The exposed sedimentary rocks are derived from deposits of the Cretaceous, Tertiary, and Quarternary systems. The rocks dating from the Cretaceous system were deposited under marine conditions, but the materials from the Tertiary and Quarternary systems were laid down by fresh water.

The deposits from the Cretaceous system are divided into the Comanche (Lower Cretaceous) and Gulf (Upper Cretaceous) series (3). The Comanche series consists of the Trinity, Fredericksburg, and Washita groups, which are further divided into formations. The formations that crop out in Uvalde County are the Glen Rose Limestone, Comanche Peak Limestone, Edwards Limestone, Kiamichi, Georgetown Limestone, Grayson Marl, and Buda Limestone Formations. The Gulf series consists of the Eagle Ford Shale, Austin Chalk, Anachacho Limestone, and Escondido Formations (8).

The Glen Rose Formation, the oldest formation exposed in Uvalde County, crops out in valleys and on lower slopes of the steeper hills in the Edwards Plateau. This formation furnished parent material for the development of Brackett and Real soils on the upper slopes and Kavett, Pratley, and Topia soils on the lower slopes and in the valleys. The layers of marl, shale, and limestone of the Glen Rose Formation are easily eroded, and rills and small gullies are common, especially in the northeastern

part of the county where the Brackett soils mainly occur. Because of the difference in the resistance to erosion of these layers, a stairstep type topography results.

The Kiamichi Formation and the Comanche Peak, Edwards, and Georgetown Limestone Formations have contributed to the development of Eckrant, Ector, Kavett, San Saba, and Speck soils as well as land types such as Limestone rock land, Rock outcrops, and Rock land. These formations are on the upper slopes and caps of the steeper hills in the northern part of the county. Further south, the Glen Rose Limestone Formation is completely covered, but the many hills in the area give rise mainly to Eckrant and Ector soils and Limestone rock land. Still further south, in the southern part of the Edwards Plateau, slopes become less steep, and Eckrant and Ector soils and Limestone rock land also are here. Throughout the area of these formations are soils such as Kavett, San Saba, Speck, Tobosa, and Volente. The more shallow Kavett and Speck soils are on the lower slopes of the hills and in the higher and more shallow valleys. The deeper San Saba, Tobosa, and Volente soils are in the valleys.

The Grayson Marl is in a narrow band between the limestone in the Georgetown Limestone and Buda Limestone Formations. This Grayson Marl Formation, which is dominantly shale that turns yellow after weathering and leads to the development of Badland, crops out in only a few small areas in the county, mainly just to the north and northwest of Uvalde. Only sparse vegetation is in the area of this formation, and it is easily eroded where it is not protected by the overlying Buda formation.

The Buda Limestone. Eagle Ford Shale, and Austin Chalk Formations are hard and soft, chalky limestone and calcareous shale and marls. These formations erode to broad, low hills and ridges that are fairly well covered with caliche and limestone fragments. They have contributed to the development of the very shallow Ector, Olmos, and Zapata soils. The limestone is near the surface of the Ector soils, but a thick bed of caliche overlies the limestone in the Olmos and Zapata soils.

The Anacacho Limestone formation, another member of the Upper Cretaceous system, is made up of hard limestone and bentonitic clay. The limestone appears more coarsely grained and browner in color than the other limestone in the county. This formation makes up most of the eastern extent of the Anacacho Mountains and is in the southwestern part of the county. These mountains were probably formed as an offshore reef when much of Uvalde County was under water. The topography of the area is undulating to moderately steep. Ector soils formed on the slopes, and Kavett and Tobosa soils formed in the small depressions and narrow valleys. Many rock outcrops occur.

The Escondido Formation consists of clay, shale, sandstone, and some limestone and crops out in small areas mainly in the southwestern part of the county.

The Tertiary system is divided into the Paleocene, Eocene, and Pliocene series. The Paleocene series is represented in Uvalde County by the Midway group and its Kincaid Formation. This formation crops out in small areas mainly along stream banks and does not give rise to any soils in the county.

The Eocene series is represented by the Wilcox group and its Indio Formation and the Clairborne group and its Carrizo Sand Formation. The Indio Formation crops out mainly in the southern and southeastern parts of the county and consists of clayey sandstone and sandy shale. Among the soils developed in these materials are those of the Caid, Duval, Webb, and Zavco series. The Carrizo Sand Formation crops out in the southeastern part of the county and consists of poorly cemented coarse to medium grained, nonmarine sandstone containing shale lenses. Among the soils developed in this material are those of the Comitas, sandy subsoil variant, Duval, and Webb.

The Pliocene series is represented by the Uvalde Gravel Formation. It consists of loose gravels intermixed with clay or gravels imbedded in caliche. These materials contributed to the formation of Hindes, Olmos, Rehm, and Yologo soils.

The Pleistocene series of the Quaternary system in Uvalde County is represented by the Leona Formation. It consists of calcareous silt and clay on broad, flat terraces, in a position intermediate between the Uvalde Gravel formation and the present flood plains of streams. The sediments of the Leona Formation were deposited by streams during the middle and upper Pleistocene Epoch (Ice Age). The soils that formed in these materials are in broad areas and are dominantly those of the Uvalde, Knippa, and Montell series. The less extensive Atco, Castroville, Mercedes, Ramadero, Sabenyo, and Valco series also formed in these materials.

The igneous rocks are intrusions of magma into the Cretaceous rocks (2). They are mainly plugs or sills of highly erosion-resistant basalt on gently sloping knolls to moderately steep hills. The basalt has contributed to the formation of Ingram soils, which are stony or gravelly dark-brown clays.

Recent geologic sediments are on all the flood plains of rivers and creeks. The thin alluvium consists of clay, silt, sand, gravels, cobbles, and boulders. The soils that have formed in these sediments are those of the Bosque, coarse subsoil variant, Conalb, Dev, Frio, and Orif series.

Formation and Classification of the Soils

This section discusses the effects of the five factors of soil formation on the soils in Uvalde County. The current system of soil classification is briefly explained, and the soils in the county are placed in some classes in the system.

Factors of Soil Formation

Soil is produced when soil-forming processes act on materials deposited or accumulated by geologic processes. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated; (3) the living organisms, or plant and animal life, in and on the soil; (4) the relief, or lay of the land; and (5) the length of time the soil-forming forces have acted on the soil material.

Climate and living organisms (chiefly vegetation) are the active factors of soil formation. They act on the parent material and slowly change it from an inert mass to one having definite morphology. The effects of climate and living organisms are conditioned by relief. The parent material also affects the kind of soil profile that forms. Finally, time is needed for the changing of the parent material into a soil having definite genetically related horizons.

The interrelationships among the five factors of soil formation are complex and continuous, and this interaction determines the kind of soil that forms. Although the effects of any one factor are difficult to isolate, it is convenient to discuss each factor of soil formation separately and to indicate some of their probable effects.

Parent material

The parent material in Uvalde County consists mainly of limestone, marl, shale, clay, sandstone, and recent alluvium. Most of these materials are calcareous and moderately alkaline, and from these, calcareous and moderately alkaline soils develop. The geology of the parent material and the soils that are within the geologic areas are discussed in more detail in the section “Geology.”

Climate

Precipitation, temperature, humidity, evaporation, and wind have all been important in the development of soils in Uvalde County. The wet climate of past geologic ages influenced the deposition of parent material.

The present climate, characterized by hot, humid summers and dry winters, has a striking effect on soil development. Indications of this effect are the kind and density

of vegetation, the organic-matter content of the soils, the leaching of soluble elements from the soil, and the activity of micro-organisms in the soil.

Low rainfall limits the vegetation to grasses, shrubs, and small trees, except in some areas along the perennial streams. This vegetation accounts for the organic-matter content of the soils. Free lime is throughout the profile of some soils because not enough water passes through them to leach it out. Most soils in Uvalde County have a layer of calcium carbonate at the depth to which water has carried this soluble material.

Almost all of the precipitation in the county is rain. When the rain falls in torrents, the runoff from steep slopes where cover is sparse removes soil material almost as fast as it forms. In places where torrents are infrequent, one hard rain can remove in a few minutes what has taken years to accumulate.

A rainfall of one-half inch may be enough to soak a very shallow, stony soil. Water runs off the stones, penetrates the soil, and finds its way under stones and into crevices where plant roots can use it. Much of the water also percolates below the zone of evaporation. On the other hand, this same amount of rain may wet only the upper two inches of a clay soil and may evaporate soon afterward. Thus, a one-half inch rain on the stony soil may be equivalent to more than an inch on the clayey soil where there are no stones. The stony soils support tall grasses; the clayey soils support short grasses.

During the hot summers and mild winters, microbial decomposition is almost continuous, and the residues from plants break down almost as fast as they accumulate. For this reason, the organic-matter content of most soils in the county is below 2.5 percent.

Living organisms

Plants, animals, insects, bacteria, fungi, and the like are important in soil formation. Native vegetation of the mixed-prairie type has contributed large amounts of organic matter to the soil. The organic matter is on the soil in the form of decaying leaves and stems. It is throughout the solum in the form of fine, fibrous, decomposed roots. These roots have left a network of tubes and pores that hasten the passage of air and water through the soil and provide abundant food for bacteria, actinomycetes, and fungi.

Plant roots may take up calcium, potassium, phosphorous, or other nutrients in lower layers of soil and then redeposit these elements on the soil surface when the plants die. Burrowing animals also mix soil horizons as they build homes or gather food.

Earthworms are noticeable in the soil. Despite the low rainfall in this county and the periods when the entire solum is dry, worm casts are common in some horizons in the Frio, Uvalde, and other series. Besides mixing the soil, earthworms increase the movement of air, water, and plant roots in a soil.

The influence of man on soil formation should not be ignored. Man has permitted the range to be over-grazed. This overgrazing has removed many kinds of grasses from the range and has encouraged other, less nutritious grasses to take their place. Much of the range now has sparse vegetation that allows large amounts of rainfall to run off and carry soil with it. The sparse vegetation also permits the soil temperature to rise in summer and the heat kills many of the microbes in the soil.

Relief

Relief, or lay of the land, has greatly influenced soil formation in Uvalde County, mainly through its effect on runoff and drainage.

The county is mostly well dissected by drainage patterns. The Edwards Plateau, which makes up the northern part of the county, is a rough region that is cut into ridges, hills, valleys, and canyons. Within short distances, elevations increase 200 to

400 feet. In much of this area, slopes of steeper limestone bedrock are exposed, runoff from rainfall is rapid, and erosion removes the soil nearly as fast as it develops.

The relief of the Anacacho Mountains in the south-western part of the county is somewhat similar to that of the Edwards Plateau, and some of the soils and rocks also are similar.

The Rio Grande Plain, which makes up the southern part of the county, consists mainly of a nearly level plain to gently sloping or undulating hills. A few nearly level to moderately steep knolls and hills of igneous material crop out in places.

Relief affects the microclimate and ecology in places. The steeper, north-facing slopes receive less sunlight, have lower soil temperatures, and have less evaporation than south-facing ones. In addition, the vegetation is thicker on most north-facing slopes, and soil organisms are more numerous. Even a few of the kinds of plants and micro-organisms are different. The north-facing slopes do not become green as early in the spring as do the south-facing ones.

Additional information on relief is given in the “Geology” section.

Time

Time is required for soil formation, and many characteristics of a soil are determined by the length of time that the soil-forming processes have acted on the soil material.

An extremely long time is needed for a soil to develop from freshly exposed, fairly pure limestone. As the mass of limestone dissolves slowly and is carried away by rainfall, any impurities present are left to form parent material. Under such conditions, many thousands of years may pass before parent materials have accumulated and horizons formed. A soil having distinct horizons may form in fresh alluvium within a few decades or centuries.

The distinctive differences between two soils that have both formed in similar material are attributable in part to the differences in the period of time during which other soil-forming factors have been at work. For example, Frio soils and Uvalde soils formed in similar material, but the Frio soils do not have a distinctive layer of calcium carbonate. Frio soils are younger than Uvalde soils. They are old enough to have a surface layer that has been darkened mainly by the addition of organic matter, and living organisms have acted on the parent material of Frio soils long enough to give them a distinct surface layer. But climate, particularly rainfall, has not acted on them long enough to leach calcium carbonate from the upper horizon and form a lower layer of calcium carbonate.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics, assemble knowledge about them, see their relationship to one another and to the whole environment, and develop principles that help us understand their behavior and response to manipulation. First, through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

Thus, in classification, soils are placed in narrow categories that are used in detailed soil surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and rangelands, in developing rural areas, in engineering work, and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in new developments should search the latest literature available (4, 6).

New soil series must be established and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at national, state, and regional levels of responsibility for soil classification results in a judgment that the new series should be established.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system, the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 8, the soil series of Uvalde County are placed in categories of the current system, family, subgroup, and order. Most of the classes of the current system are briefly defined in the following paragraph.

ORDER. Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, occur in many different climates.

The six orders represented in Uvalde County are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, and Alfisols. They are briefly defined in the following paragraphs.

Entisols are young mineral soils that do not have genetic horizons or have only the beginning of such horizons.

Vertisols are soils in which natural churning or inversion of soil material takes place, mainly through the swelling and shrinking of clays.

Inceptisols are mineral soils in which horizons have definitely started to form. They generally are on young, but not recent, land surfaces.

Ardisols are primarily soils of dry places. They have a light-colored surface soil, and some have a clay enriched B horizon high in base saturation. Others have free carbonates throughout their profile.

Mollisols are dark-colored soils that have a moderate to high content of organic matter and high base saturation. Some have a clay-enriched B horizon, and others have free carbonates throughout their profile.

Alfisols are soils containing a clay-enriched B horizon that has high base saturation.

SUBORDER. Each order is subdivided into suborders, primarily on the basis of those characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. Soil properties used to separate suborders mainly reflect either the presence or the absence of waterlogging or soil differences resulting from the climate or vegetation.

GREAT GROUP. Suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans that interfere with growth of roots or movement of water. The soil features used in separating soils into great groups are the self-mulching properties of clays, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, potassium), and the like. The great group is not shown separately in table 8 because it is the last word in the name of the subgroup.

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and the others, called intergrades, that have properties of one great group and also one or more properties of another great group, subgroup, or order. Subgroups may also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order.

The names of subgroups are derived by placing one or more adjectives before the name of the great group.

FAMILY. Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, thickness of horizons, and consistence.

SERIES. As explained in the section “How This Survey Was Made,” the series is a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and arrangement in the profile.

Climate

By Robert B. Orton, State climatologist, National Weather Service, U.S. Department of Commerce

Uvalde County has a subtropical climate characterized by dry winters and hot, humid summers. The average annual rainfall is 23.70 inches, but rainfall amounts vary greatly from month to month and from year to year. About one year in ten, total rainfall will be less than 13.6 inches; and about one year in ten, rainfall will exceed 35.4 inches. Sixty-eight percent of this falls during the warm season, May through October. Rain occurs most frequently as the result of thunderstorm activity, and the maximum amount usually falls during the late spring and early summer months. A secondary rainfall peak occurs in September as cold fronts begin to push into the region. An occasional tropical disturbance moving westward from the Gulf of Mexico may also bring heavy rains in the early fall. Monthly rainfall totals decrease sharply in November as frequent surges of polar and Arctic air masses cut off the supply of moisture from the Gulf. The small amounts of precipitation from November through March usually fall as steady, light rain. It is unusual for an entire month to pass without some measurable precipitation, although the amount may be small. During exceptionally wet years, the precipitation results mainly from excessive downpours that cause rapid runoff and erosion of the soil. Average annual lake evaporation is 70 inches.

Uvalde County experiences a wide annual range in temperature, a characteristic of continental type climates. Winters are quite mild. Cold periods are ushered in by strong, dry, dusty north and northwest winds known as “northers” that may cause temperature drops of as much as 25°F. in a few hours. Cold weather periods usually do not last more than 48 hours. Sleet or snow falls about once each year; it frequently melts as it falls.

Hot weather is rather persistent from late May to mid-September. The daily maximum temperature exceeds 99°F. on about 41 days per year. The low humidity, however, tends to alleviate uncomfortable conditions usually associated with high temperatures.

Prevailing winds are southeasterly throughout the year. Uvalde County receives 62 percent of the total possible sunshine annually. The morning hours are often cloudy during the colder months of the year, but the clouds frequently dissipate during the late morning or early afternoon.

The average length of the growing season (freeze-free period) is 256 days. The average date of the last 32°F. freeze in the spring is March 8, and the average date of the first freeze in the fall is November 19. During an average year the temperature will fall to 32°F. or below 26 times. Tables 9 and 10 give a summary of precipitation and temperature in the county as well as the probabilities of occurrence of selected temperatures during the year.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed available moisture capacity). The capacity of a soil to hold water in a form available to plants. It is the numerical difference between the percentage of water at field capacity and the percentage of water at the time plants wilt. The rate is expressed as inches of water per inch of soil depth.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Climax vegetation. The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.

Coarse fragments. Mineral or rock particles more than 2 millimeters in diameter.

Cobbles. Rounded or partly-rounded fragments of rock, 3 to 10 inches in diameter.

Coefficient of linear extensibility (COLE). One of two quantitative methods for determining shrink-swell behavior of a soil. An estimate of vertical component of swelling of a natural soil clod. Defined as $\frac{Lm - Ld}{Lb}$ where Lm = length of Ld moist samples and Ld = length of dry samples.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; does not hold together in a mass when dry or moist.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Deferred grazing. The practice of delaying grazing until range plants have reached a definite stage of growth, in order to increase the vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls, in nearly level areas, or of microvalleys and microridges that run with the slope.

Gravel. As a soil separate, the rounded or angular fragments of rock that range in size from 2 millimeters to 3 inches in diameter. As a soil textural class, soil material that consists of 15 to 50 percent gravel, by volume. In engineering, gravel is a course-grained soil of which more than 50 percent is retained on a No. 4 screen.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an 0 horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Marl. An earthy, unconsolidated deposit formed in fresh-water lakes that consists chiefly of calcium carbonate mixed with various amounts of clay or other impurities.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7 indicates precise neutrality; a higher value indicates alkalinity; and a lower value, acidity.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2 millimeters. Most sand grains consist of quartz, but they may be of any

mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays where there is marked change in moisture content.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stones. Rock fragments greater than 10 inches in diameter if rounded, and greater than 15 inches along the longer axis if flat.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Variant soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Tables

The tables in this soil survey contain information that affects land use planning in this survey area. More current data tables may be available from the Web Soil Survey at the Tabular Data tab.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Area	Extent
	Acres	*Percent*
Atco loam, 0 to 1 percent slopes	14,160	1.4
Atco loam, 1 to 3 percent slopes	8,321	.8
Badland	544	.1
Bosque loam, coarse subsoil variant	1,465	.1
Brackett and Real soils, undulating [1]	9,808	1.0
Brackett and Real soils, hilly [1]	3,222	.3
Caid sandy clay loam, 0 to 1 percent slopes	467	.1
Caid sandy clay loam, 1 to 3 percent slopes	1,097	.1
Castroville clay loam, 0 to 1 percent slopes	13,213	1.3
Castroville clay loam, 1 to 3 percent slopes	2,313	.2
Comitas fine sand, sandy subsoil variant	723	.1
Conalb loam	4,879	.5
Dant and Uvalde soils, 0 to 1 percent slopes	2,072	.2
Dant and Uvalde soils, 1 to 3 percent slopes	2,594	.3
Dev soils	21,551	2.1
Duval fine sandy loam, 1 to 3 percent slopes	2,441	.2
Eckrant soils, undulating [1]	20,577	2.0
Eckrant-Kavett complex, 0 to 5 percent slopes	7,183	.7
Ector soils, undulating [1]	41,535	4.1
Ector soils and Rock outcrop, hilly [1]	52,499	5.2
Frio silty clay loam, 0 to 1 percent slopes	10,495	1.0
Frio silty clay loam, 1 to 3 percent slopes	2,399	.2
Frio silty clay loam, frequently flooded	4,212	.4
Hindes and Yologo soils, undulating [1]	25,698	2.5
Ingram gravelly soils, 0 to 5 percent slopes	4,484	.4
Ingram stony soils, hilly	4,831	.5
Kavett clay, 0 to 3 percent slopes	13,958	1.4
Knippa clay, 0 to 1 percent slopes	84,491	8.3
Knippa clay, 1 to 3 percent slopes	16,694	1.6
Limestone rock land [1]	89,283	8.8
Mercedes clay	4,396	.4
Montell clay, 0 to 1 percent slopes	40,463	4.0
Montell clay, 1 to 3 percent slopes	4,669	0.5
Olmos soils, undulating [1]	46,359	4.6
Olmos and Ector soils, undulating [1]	52,988	5.2
Orif soils	3,743	.4
Pratley clay, 0 to 3 percent slopes	17,534	1.7
Ramadero sandy clay loam	3,171	.3
Randado fine sandy loam, 1 to 3 percent slopes	3,373	.3
Real and Eckrant soils, undulating [1]	49,158	4.8
Rehm soils, undulating	1,188	.1
Rock land-Real association, steep [1]	126,857	12.5
Sabenyo clay loam, 1 to 5 percent slopes	5,757	.6
San Saba clay	1,224	.1
San Saba stony clay	795	.1
Speck soils, undulating	27,044	2.7
Tobosa clay, 0 to 1 percent slopes	7,321	.7
Tobosa clay, 1 to 3 percent slopes	4,490	.4
Topia clay, 0 to 3 percent slopes	6,892	.7
Uvalde silty clay loam, 0 to 1 percent slopes	75,946	7.5
Uvalde silty clay loam, 1 to 3 percent slopes	32,847	3.2
Valco clay loam, 0 to 3 percent slopes	10,473	1.0
Volente clay loam, 0 to 1 percent slopes	1,910	.2
Volente clay loam, 1 to 3 percent slopes	756	.1
Webb fine sandy loam, 0 to 1 percent slopes	744	.1
Webb fine sandy loam, 1 to 3 percent slopes	3,335	.3
Zapata soils	995	.1
Zavco sandy clay loam, 0 to 1 percent slopes	1,701	.2
Zavco sandy clay loam, 1 to 3 percent slopes	2,387	.2
Pit	471	.1
Water areas and river gravel	10,124	1.0
Total	1,016,320	100.0

[1] This is a low intensity mapping unit. It is more variable than other units in the county but has been controlled well enough that interpretations for the expected use of the soil can be made.

TABLE 2.—*Estimated average yields per acre of principal irrigated and dryland crops*

[illegible]

Soil	Irrigated: Grain sorghum	Cotton	Corn	Onions	Carrots	Irrigated—Continued: Cabbage	Improved bermudagrass (hay)	Improved bermudagrass (grazing)	Dryland: Grain sorghum	Oats	Small grain (grazing)	Hybrid sorghum (grazing)	Blue panicum (grazing)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

TABLE 3.—*Interpretations of the soils for elements of wildlife habitat and for kinds of wildlife*

Soil series and map symbols	Elements of wildlife habitat: Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Elements of wildlife habitat—Continued: Hardwood trees and shrubs	Wetland food and cover plants	Shallow water developments	Kinds of wildlife: Open land wildlife	Rangeland wildlife	Wetland wildlife
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE 4.—*Estimated soil properties significant to engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series in the first column of this table. Absence of data indicates that no estimates were made for the property. The symbol > means "more than," the symbol < means "less than"]

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Classification			Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
				USDA texture	Unified	AASHO		No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
		Inches	*Inches*				*Percent*					*Inches per hour*	*Inches per hour*		
Atco: AtA, AtB	B	>60	0-72	Loam to sandy clay loam	CL	A-4 or A-6	0-5	95-100	95-100	85-95	65-85	0.63-2.0	0.10-0.15	7.9-8.4	Low.
Bandland: Bd. Properties too variable to rate.															
Bosque loam, coarse subsoil variant: Bo	B	>60	0-12	Loam	CL	A-6	0-5	90-100	90-100	80-95	50-70	0.63-2.0	0.10-0.15	7.9-8.4	Low.
			12-60	Fine sandy loam	SC or CL	A-6	0-5	90-100	90-100	75-90	35-55	0.63-2.0	0.10-0.15	7.9-8.4	Low.
*Brackett: BRB, BRE. For Real part of BRB and BRE, see Real series.	C	10-20	0-14	Loam	SC or CL	A-6	0-20	70-100	65-100	60-95	45-75	0.20-0.63	0.10-0.15	7.9-8.4	Low.
			14-72	Limestone, weakly cemented.											
Cald: CaA, CaB	B	>60	0-25	Sandy clay loam	SC or CL	A-6	0	98-100	98-100	80-90	35-55	0.63-2.0	0.10-0.15	7.9-8.4	Low.
			25-35	Clay loam	SC or CL	A-6 or A-7	0	95-100	95-100	85-95	45-60	.63-2.0	0.10-0.15	7.9-8.4	Low.
			35-76	Sandy clay loam	SC or CL	A-6	0	90-100	90-100	85-95	40-60	0.63-2.0	0.10-0.15	7.9-8.4	Low.
Castroville: CcA, CcB	B	>60	0-50	Clay loam to clay	CL	A-7-6	0	98-100	95-100	90-98	80-90	0.63-2.0	0.15-0.2	7.9-8.4	Moderate.
			50-64	Clay	CL	A-6 or A-7-6	0	85-100	80-95	80-95	75-90	0.63-2.0	0.10-0.15	7.9-8.4	Low.
Comitas fine sand, sandy subsoil variant: Cm	A	>60	0-24	Fine sand	SM	A-2-4	0	100	100	90-100	15-25	2.0-6.3	0.07-0.1	5.1-6.5	Low.
			24-54	Loamy fine sand	SM	A-2-4	0	100	100	90-100	20-35	2.0-6.3	0.07-0.1	5.1-6.5	Low.
			54-84	Fine sandy loam	SM-SC	A-4	0	100	100	80-90	40-50	2.0-6.3	0.11-0.15	5.1-6.5	Low.
Conalb: Co	B	>60	0-64	Loam and very fine sandy loam (stratified).	CL or ML-CL	A-6 or A-4	0	90-100	90-100	80-95	50-70	0.63-2.0	0.10-0.15	7.9-8.4	Low.
*Dant: DaA, DaB. For Uvalde part of DaA and DaB, see Uvalde series.	D	>60	0-12	Clay loam	CL	A-6 or A-7	0	100	95-100	90-100	70-80	0.20-0.63	0.15-0.2	7.9-8.4	Moderate.
			12-34	Clay	CH	A-7-6	0	100	95-100	90-100	75-95	0.06-0.2	0.15-0.2	7.9-8.4	High.
			34-60	Clay	CL or CH	A-7-6	0	100	95-100	90-100	75-95	0.06-0.2	0.10-0.15	7.9-8.4	High.
Dev: De	B	>60	0-16	Very gravelly clay loam	GC or GM-GC; SC or SM-SC	A-2	0-10	35-65	20-65	20-45	10-35	2.0-6.3	0.05-0.1	7.9-8.4	Low.
			16-42	Very gravelly clay loam and loam.	GC or GM-GC; SC or SM-SC	A-2	5-20	15-65	10-65	10-45	10-35	2.0-6.3	0.05-0.1	7.9-8.4	Low.
Duval: DuB	B	40-60	0-12	Fine sandy loam	SM or SC	A-2 or A-4	0	98-100	98-100	60-80	25-50	0.63-2.0	0.10-0.15	6.1-6.5	Low.
			12-46	Sandy clay loam	SC or CL	A-6 or A-4	0	98-100	98-100	70-90	35-55	0.63-2.0	0.10-0.15	6.1-7.3	Low.
			46-54	Soft sandstone.											
*Eckrant: ECB, EkC. For Kavett part of EkC, see Kavett series.	D	4-20	0-12	Gravelly clay	GC or SC	A-2-7 or A-7-6	15-60	45-80	40-75	35-55	30-50	0.20-0.63	0.10-0.15	6.6-8.4	High.
			12-30	Indurated limestone bedrock.											
Ector: EOB, ERE	D	4-19	0-15	Cobbly clay loam	GC or SC	A-2	15-60	30-70	20-65	15-50	12-35	0.63-2.0	0.05-0.1	7.9-8.4	Low.
			15-20	Indurated limestone bedrock.											
Frio: FoA, FoB, Fs	B	>60	0-60	Silty clay loam or clay loam	CL	A-6 or A-7-6	0	95-100	95-100	75-100	70-95	0.20-0.63	0.15-0.2	7.9-8.4	Moderate.
*Hindes: HYB. For Yologo part of HYB, see Yologo series.	C	>60	0-8	Gravelly sandy clay loam	GC or SC	A-4 or A-6	0-5	50-95	50-95	45-75	35-50	0.63-2.0	0.10-0.15	6.1-7.8	Low.
			8-31	Very gravelly clay	GC	A-2 or A-6-7	0-15	20-70	20-65	20-60	20-50	0.20-0.63	0.05-0.1	6.1-7.8	Moderate.
			31-60	Caliche of clay loam texture	CL	A-6	0-5	85-95	80-95	75-90	65-80	0.20-0.63	<0.06	7.9-8.4	Low.
Ingram: IgC, InD	D	20-48	0-42	Clay and cobbly clay	CH	A-7-6	15-35	75-95	65-90	65-90	60-85	0.06-0.2	0.10-0.2	6.6-8.4	High.
			42-60	Indurated basalt.											

TABLE 4.—*Estimated soil properties significant to engineering*—Continued

Soil series and maps symbol	Hydrologic group	Depth to bedrock	Depth from surface	Classification			Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
				USDA texture	Unified	AASHO		No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
		Inches	*Inches*												
Kavett: KaB	D	13–20	0–16	Clay	CH or MH-CH	A–7–6	0–5	90–100	90–100	85–100	80–95	0.20–0.63	0.15–0.2	7.9–8.4	High.
			16–18	Strongly cemented caliche.											
			18–36	Limestone and marl.											
Knippa: KnA, KnB	D	>60	0–35	Clay	CH or CL	A–7–6	0	90–100	85–100	80–98	75–95	0.20–0.63	0.15–0.2	7.9–8.4	High.
			35–60	Clay loam	CH or CL	A–7–6 or A–6	0	90–100	85–100	78–97	70–95	0.20–0.63	0.15–0.2	7.9–8.4	High.
Limestone rock land: LS. Properties too variable to rate.															
Mercedes: Me	D	>60	0–74	Clay	CH	A–7–6	0	100	100	100	75–90	0.02–0.05	0.12–0.14	7.9–8.4	High.
Montell: MoA, MoB	D	>60	0–72	Clay	CH	A–7–6	0	100	95–100	90–100	85–96	<0.06	0.15–0.2	7.9–8.4	High.
*Olmos: OLB, OMB. For Ector part of OMB, see Ector series.	C	7–20	0–13	Gravelly loam	GC, GM, or SC	A–2–6 or A–2–4	10–35	35–75	25–65	25–55	20–35	0.63–2.0	0.05–0.1	7.9–8.4	Low.
			13–14	Indurated caliche.											
			14–26	Weakly cemented caliche.											
Orif: Or	A	>60	0–12	Fine sandy loam	SM or SM-SC	A–2–4 or A–4	0–5	80–95	75–95	40–60	20–40	6.3–20.0	0.05–0.1	7.9–8.4	Low.
			12–40	Very gravelly sand	GW, GP, or GM; SP or SM	A–1	0–15	20–70	10–65	5–35	0–20	6.3–20.0	<0.06	7.9–8.4	
			40–80	Sand	GM or SM	A–1	0–15	50–85	40–75	30–50	5–20	6.3–20.0	<0.06	7.9–8.4	
Pratley: PrB	C	22–40	0–8	Clay	CL or CH	A–7–6	0	90–100	90–100	80–95	75–90	0.63–2.0	0.15–0.2	6.6–8.4	High.
			8–35	Clay	CH	A–7–6	0	95–100	95–100	80–95	80–90	0.20–0.63	0.15–0.2	7.4–8.4	High.
			35–40	Indurated caliche.											
			40–54	Limestone.											
Ramadero: Ra	C	>60	0–19	Sandy clay loam	SC or CL	A–6	0	100	100	95–100	45–60	0.63–2.0	0.15–0.2	6.6–8.4	Low.
			19–60	Sandy clay loam	CL	A–6	0	100	100	95–100	50–65	0.63–2.0	0.15–0.2	6.6–8.4	Low.
Randado: RdB	C	12–20	0–5	Fine sandy loam	SM-SC or ML-CL	A–4	0	95–100	90–100	65–85	35–55	0.63–2.0	0.10–0.15	6.6–7.8	Low.
			5–14	Sandy clay loam	SC or CL	A–2–4, A–2–6, A–4, or A–6	0–5	90–100	90–100	75–90	30–55	0.63–2.0	0.10–0.15	6.6–7.8	Low.
			14–17	Cobbly sandy clay loam	SC	A–2–4, A–2–6, A–4, or A–6	40–90	65–75	50–70	40–60	25–45	0.63–2.0	0.10–0.15	6.6–7.8	Low.
			17–26	Caliche: indurated in upper part; weakly cemented below.											
*Real: REB. For Eckrant part of REB, see Eckrant series.	D	8–20	0–13	Gravelly clay loam	GC or SC	A–2–6	10–30	40–75	30–65	25–50	20–35	0.63–2.0	0.05–0.1	7.9–8.4	Moderate.
			13–36	Weakly cemented limestone.											
Rehm: RhB	C	30–60	0–10	Gravelly clay loam	SC	A–2 or A–6	0–5	60–85	50–85	40–75	30–50	0.63–2.0	0.10–0.15	7.9–8.4	Low.
			10–25	Very gravelly clay loam	GC or SC	A–2 or A–6	0–10	25–70	20–65	20–60	20–50	0.63–2.0	0.05–0.1	7.9–8.4	Low.
			25–42	Clay loam	CL	A–6 or A–7–6	0–5	85–100	75–95	55–85	50–75	0.63–2.0	0.10–0.15	7.9–8.4	Low.
			42–66	Sandy clay loam and chalk.											
*Rock land: RRE. For Real part of RRE, see Real series. Properties too variable to rate.															

TABLE 4.—*Estimated soil properties significant to engineering*—Continued

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Classification			Coarse fraction greater than 3 inches	Percentage less than 3 inches passing sieve—				Permeability	Available water capacity	Reaction	Shrink-swell potential
				USDA texture	Unified	AASHO		No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)				
		Inches	*Inches*												
Sabenyo: SaC	B	>60	0-17	Clay loam	CL	A-6 or A-4	0	95-100	95-100	85-95	65-85	0.63-2.0	0.10-0.15	7.9-8.4	Low.
			17-55	Clay loam	CL	A-6	0	75-95	65-85	65-80	60-75	0.63-2.0	0.05-0.1	7.9-8.4	Low.
			55-85	Sandy loam	CL, SC, or SM-SC	A-4 or A-6	0	95-100	95-100	60-70	35-55	0.63-2.0	0.05-0.1	7.9-8.4	Low.
San Saba: Sb, Sc	D	24-40	0-29	Clay	CH	A-7-6	0-15	80-100	80-100	80-100	75-100	<0.07	0.15-0.2	7.4-8.4	High.
			29-30	Indurated limestone bedrock.											
Speck: SpB	D	14-20	0-8	Clay	CL	A-6 or A-7-6	0-10	90-100	90-100	80-95	75-90	0.20-0.63	0.15-0.2	6.1-7.8	Low.
			8-17	Clay	CL or CH	A-7-6	0-10	75-95	75-95	75-95	60-95	0.06-0.2	0.15-0.2	6.1-7.8	Moderate.
			17-18	Limestone bedrock.											
Tobosa: ToA, ToB	D	>60	0-46	Clay	CH	A-7-6	0	100	100	90-100	85-95	<0.07	0.15-0.2	7.9-8.4	High.
			46-56	Gravelly clay	CH	A-7-6	0-5	60-95	60-95	55-90	50-90	<0.07	0.10-0.15	7.9-8.4	High.
Topia: TpB	D	21-40	0-7	Clay	CL or CH	A-7-6	0	85-100	85-100	80-95	75-90	0.06-0.2	0.15-0.2	6.1-7.8	High.
			7-22	Clay	CH	A-7-6	0	85-100	85-100	80-95	80-95	<0.07	0.15-0.2	6.1-7.8	High.
			22-30	Clay and very gravelly clay	GC, SC, CL, or CH	A-2-7 or A-7-6	0-5	45-95	40-90	30-80	20-70	0.06-0.2	0.15-0.2	7.4-8.4	Moderate.
			30-48	Weakly consolidated limestone.											
Uvalde: UvA, UvB	C	>60	0-35	Silty clay loam	CL	A-7-6	0	98-100	95-100	90-98	80-91	0.63-2.0	0.15-0.2	7.9-8.4	Low.
			35-80	Silty clay loam	CL	A-6 or A-7-6	0	85-100	80-99	80-96	75-90	0.63-2.0	0.10-0.15	7.9-8.4	Low.
Valco: VaB	C	13-20	0-17	Clay loam and very gravelly clay loam.	CL	A-6	0-5	80-95	75-90	60-80	50-70	0.63-2.0	0.10-0.15	7.9-8.4	Low.
			17-19	Strongly cemented caliche.											
			19-36	Weakly cemented caliche.											
Volente: VoA, VoB	C	>60	0-12	Clay loam	CL	A-6	0	90-100	95-100	95-100	75-85	0.63-2.0	0.15-0.2	7.9-8.4	Moderate.
			12-35	Clay	CL or CH	A-7-6	0	95-100	95-100	95-100	85-95	0.20-0.63	0.15-0.2	7.9-8.4	High.
			35-60	Clay	CL or CH	A-7-6	0	95-100	95-100	95-100	85-95	0.20-0.63	0.15-0.2	7.9-8.4	High.
Webb: WeA, WeB	C	36-60	0-9	Fine sandy loam	SM-SC, SC, or ML	A-2 or A-4	0	98-100	98-100	60-80	25-55	0.63-2.0	0.10-0.15	5.6-6.0	Low.
			9-14	Sandy clay loam	SC or CL	A-6	0	98-100	98-100	70-90	35-60	0.63-2.0	0.15-0.2	6.1-7.8	Low.
			14-46	Sandy clay	CL	A-6 or A-7-6	0	98-100	98-100	80-95	50-75	0.20-0.63	0.15-0.2	6.1-7.8	Moderate.
			46-60	Sandy clay loam	SC or CL	A-6	0	98-100	95-100	70-80	35-55	0.63-2.0	0.10-0.15	7.9-8.4	Low.
Yologo: Mapped only with Hindes soils.	D	8-19	0-5	Gravelly loam	GC or SC	A-1-2 or A-4-6	0-5	25-95	25-95	20-70	20-50	0.63-2.0	0.10-0.15	6.1-7.8	Low.
			5-12	Very gravelly clay loam	GC or SC	A-2 or A-6	0-10	20-70	20-65	20-60	20-50	0.63-2.0	0.05-0.1	6.1-7.8	Low.
			12-14	Indurated caliche plates.											
			14-24	Clay loam caliche	SC or CL	A-6	0	80-95	75-95	50-75	40-60	0.63-2.0	<0.06	7.9-8.4	Low.
Zapata: Za	C	3-10	0-5	Loam	SC or CL	A-4 or A-6	0-20	85-95	75-95	75-90	40-65	0.63-2.0	0.10-0.15	7.9-8.4	Low.
			5-9	Indurated caliche.											
			9-30	Weakly cemented caliche.											
Zavco: ZcA, ZcB	C	40-60	0-17	Sandy clay loam	SC or CL	A-6	0	95-100	95-100	80-90	40-65	0.63-2.0	0.10-0.15	6.1-7.8	Low.
			17-42	Sandy clay	CL	A-6 or A-7	0	95-100	95-100	85-95	50-75	0.20-0.63	0.10-0.15	7.4-8.4	Moderate.
			42-54	Sandy clay loam	SC or CL	A-6	0-10	85-100	90-100	70-85	45-65	0.63-2.0	0.10-0.15	7.9-8.4	Low.
			54-55	Weakly consolidated sandstone.											

TABLE 5.—*Interpretations of engineering properties of the soils for use in farming and recreation*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series in the first column of this table. Absence of data indicates that no estimates were made for the property]

Soil series and map symbols	Degree of limitation and features affecting—				Degree of limitation and features affecting—Continued			Soil features affecting—	
	Camp areas	Picnic areas	Playgrounds	Paths and trails	Ponds: Reservoir areas	Ponds: Embankments	Irrigation	Terraces and diversions	Grassed waterways
Atco: AtA, AtB	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.	Slight	Severe: seepage	Moderate: medium compressibility; fair to good resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.
Badland: Bd. Properties too variable to rate.									
Bosque loam, coarse subsoil variant: Bo.	Severe: flooding hazard.	Moderate: flooding hazard.	Moderate: flooding hazard.	Slight	Moderate: moderate permeability.	Moderate: medium compressibility; poor resistance to piping and erosion.	Subject to infrequent flooding.	Subject to infrequent flooding.	Subject to infrequent flooding.
*Brackett: BRB, BRE For Real part of BRB and BRE, see Real series.	Moderate where slopes are 2 to 15 percent; moderately slow permeability. Severe where slopes are 15 to 30 percent.	Slight where slopes are 2 to 8 percent. Moderate where slopes are 8 to 15 percent. Severe where slopes are 15 to 30 percent.	Moderate where slopes are 2 to 6 percent; moderately slow permeability. Severe where slopes are 6 to 30 percent.	Slight where slopes are 2 to 6 percent. Moderate where slopes are 6 to 15 percent. Severe where slopes are 15 to 30 percent.	Severe: seepage	Moderate: medium compressibility; fair resistance to piping and erosion.	Limestone at a depth of less than 20 inches; slopes; low available water capacity.	Less than 20 inches of borrow material.	Limestone at a depth of less than 20 inches; low available water capacity.
Cald: CaA, CaB	Moderate: sandy clay loam.	Moderate: sandy clay loam.	Moderate: sandy clay loam; 0 to 3 percent slopes.	Moderate: sandy clay loam.	Moderate: moderate permeability.	Moderate: medium compressibility; fair to good resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.
Castroville: CcA, CcB	Moderate: clay loam	Moderate: clay loam	Moderate: clay loam	Moderate: clay loam	Severe: seepage	Moderate: medium compressibility; fair to good resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.
Comitas fine sand, sandy subsoil variant: Cm.	Severe: loose sand	Severe: loose sand	Severe: loose sand	Severe: loose sand	Severe: moderately rapid permeability.	Moderate: fair slope stability; poor resistance to piping and erosion.	Low available water capacity.	Poor stability	Low available water capacity.
Conalb: Co	Severe: flooding hazard.	Moderate: flooding hazard.	Moderate: flooding hazard.	Slight	Severe: seepage	Moderate: medium compressibility; fair to good resistance to piping and erosion.	Subject to infrequent flooding.	Subject to infrequent flooding.	Subject to infrequent flooding.
*Dant: DaA, DaB For Uvalde part of DaA and DaB, see Uvalde series.	Moderate: clay loam; slow permeability.	Moderate: clay loam	Moderate: clay loam; slow permeability.	Moderate: clay loam	Slight	Moderate: fair slope stability; high compressibility.	Features generally favorable.	Features generally favorable.	Features generally favorable.
Dev: De	Severe: flooding hazard; 50 to 80 percent coarse fragments.	Severe: flooding hazard; 50 to 80 percent coarse fragments.	Severe: flooding hazard; 20 to 80 percent coarse fragments.	Severe: 50 to 80 percent coarse fragments.	Severe: moderately rapid permeability.	Severe: poor resistance to piping and erosion.	Subject to frequent flooding; low available water capacity.	Subject to frequent flooding.	Subject to frequent flooding; low available water capacity.
Duval: DuB	Slight	Slight	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.	Slight	Moderate: moderate permeability.	Moderate: fair slope stability; poor resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.
*Eckrant: ECB, EkC For Kavett part of EkC, see Kavett series.	Severe: stony clay; 50 to 85 percent coarse fragments.	Severe: stony clay; 50 to 85 percent coarse fragments.	Severe: stony clay; 50 to 85 percent coarse fragments.	Severe: stony clay; 50 to 85 percent coarse fragments.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: 4 to 20 inches of borrow material.	Limestone at a depth of 4 to 20 inches; low available water capacity.	4 to 20 inches of borrow material.	Limestone at a depth of 4 to 20 inches; low available water capacity.

TABLE 5.—*Interpretations of engineering properties of the soils for use in farming and recreation*—Continued

Soil series and map symbols	Degree of limitation and features affecting—				Degree of limitation and features affecting—Continued		Soil features affecting—		
	Camp areas	Picnic areas	Playgrounds	Paths and trails	Ponds: Reservoir areas	Ponds: Embankments	Irrigation	Terraces and diversions	Grassed waterways
Ector: EOB, ERE	Moderate where slopes are 8 to 15 percent and coarse fragments are 35 to 50 percent; stony clay loam. Severe where slopes are 15 to 20 percent and coarse fragments are 50 to 75 percent.	Moderate where slopes are 8 to 15 percent and coarse fragments are 35 to 50 percent; stony clay loam. Severe where slopes are 15 to 20 percent and coarse fragments are 50 to 75 percent.	Severe: bedrock at a depth of 4 to 19 inches; 6 to 20 percent slopes; 35 to 75 percent coarse fragments.	Moderate where coarse fragments are 35 to 50 percent. Severe where coarse fragments are 50 to 75 percent.	Severe: bedrock at a depth of 4 to 19 inches.	Severe: 4 to 19 inches of borrow material.	Limestone at a depth of less than 19 inches; low available water capacity.	Less than 19 inches of borrow material.	Limestone at a depth of less than 19 inches; low available water capacity.
Frio: FoA, FoB, Fs	Severe: flooding hazard.	Moderate: silty clay loam; flooding hazard.	Moderate where flooding is infrequent; silty clay loam. Severe where flooding is frequent.	Moderate: silty clay loam.	Moderate: moderately slow permeability.	Moderate: medium compressibility; fair to good resistance to piping and erosion.	Subject to infrequent to frequent flooding.	Subject to infrequent to frequent flooding.	Subject to infrequent to frequent flooding.
*Hindes: HYB. For Yologo part of HYB, see Yologo series.	Moderate: sandy clay loam; moderately slow permeability.	Moderate: sandy clay loam.	Moderate where slopes are 2 to 6 percent; sandy clay loam; moderately slow permeability. Severe where slopes are 6 to 8 percent and coarse fragment are 20 to 50 percent.	Moderate: sandy clay loam.	Severe: seepage.	Moderate: medium compressibility; fair to good resistance to piping and erosion.	Low available water capacity; slopes.	10 to 50 percent coarse fragments.	Low available water capacity; 10 to 50 percent coarse fragments.
Ingram: IgC, InD	Severe: clay; 15 to 70 percent stones and boulders.	Severe: clay; 15 to 70 percent stones and boulders.	Severe: clay; 15 to 70 percent stones and boulders.	Severe: clay; 15 to 70 percent stones and boulders.	Moderate where bedrock is at a depth of 36 to 48 inches. Severe where bedrock is at a depth of 20 to 36 inches.	Severe: 15 to 70 percent stones and boulders.	15 to 70 percent surface stones.	15 to 70 percent surface stones.	15 to 70 percent surface stones.
Kavett: KaB	Severe: clay.	Severe: clay.	Severe: clay.	Severe: clay.	Severe: bedrock at a depth of 13 to 20 inches.	Severe: 13 to 20 inches of borrow material.	Bedrock at a depth of less than 20 inches.	Less than 20 inches of borrow material.	Bedrock at a depth of less than 20 inches.
Knippa: KnA, KnB	Severe: clay.	Severe: clay.	Severe: clay.	Severe: clay.	Moderate: moderately slow permeability.	Moderate: fair slope stability; high compressibility.	Features generally favorable.	Features generally favorable.	Features generally favorable.
Limestone rock land: LS. Properties too variable to rate.									
Mercedes: Me	Severe: clay; very slow permeability.	Severe: clay.	Severe: clay; very slow permeability.	Severe: clay.	Slight.	Moderate: fair slope stability; high compressibility.	Moderately well drained.	Features generally favorable.	Features generally favorable.
Montell: MoA, MoB	Severe: clay; very slow permeability.	Severe: clay.	Severe: clay; very slow permeability.	Severe: clay.	Slight.	Moderate: fair slope stability; high compressibility.	Moderately well drained.	Features generally favorable.	Features generally favorable.
*Olmos: OLB, OMB. For Ector part of OMB, see Ector series.	Moderate where coarse fragments are 35 to 50 percent. Severe where coarse fragments are 50 to 75 percent.	Moderate where coarse fragments are 35 to 50 percent. Severe where coarse fragments are 50 to 75 percent.	Severe: 35 to 75 percent coarse fragments.	Moderate where coarse fragments are 35 to 50 percent. Severe where coarse fragments are 50 to 75 percent.	Severe: indurated caliche at a depth of 7 to 20 inches.	Severe: 7 to 20 inches of borrow material.	Caliche at a depth of less than 20 inches; low available water capacity; slopes.	Less than 20 inches of borrow material.	Caliche at a depth of less than 20 inches; low available water capacity.
Orif: Or	Severe: flooding hazard.	Moderate: flooding hazard.	Moderate where coarse fragments are 10 to 20 percent; flooding hazard. Severe where coarse fragments are 20 to 25 percent	Slight where coarse fragments are 10 to 20 percent. Moderate where coarse fragments are 20 to 25 percent.	Severe: rapid permeability.	Severe: rapid permeability.	Subject to frequent flooding; low available water capacity.	Subject to frequent flooding.	Subject to frequent flooding; low available water capacity.

TABLE 5.—*Interpretations of engineering properties of the soils for use in farming and recreation*—Continued

Soil series and map symbols	Degree of limitation and features affecting—				Degree of limitation and features affecting—Continued		Soil features affecting—		
					Ponds				
	Camp areas	Picnic areas	Playgrounds	Paths and trails	Reservoir areas	Embankments	Irrigation	Terraces and diversions	Grassed waterways
Pratley: PrB	Severe: clay	Severe: clay	Severe: clay	Severe: clay	Severe: seepage	Moderate: fair slope stability; high compressibility.	Indurated caliche at a depth of 22 to 40 inches.	Features generally favorable.	Features generally favorable.
Ramadero: Ra	Moderate: sandy clay loam.	Moderate: sandy clay loam.	Moderate: sandy clay loam.	Moderate: sandy clay loam.	Moderate: moderate permeability.	Moderate: medium compressibility; fair to good resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.
Randado: RdB	Slight	Slight	Slight where slopes are 1 to 2 percent. Moderate where slopes are 2 to 3 percent.	Slight	Severe: seepage	Severe: 12 to 20 inches of borrow material.	Caliche at a depth of less than 20 inches; low available water capacity.	Less than 20 inches of borrow material.	Caliche at a depth of less than 20 inches; low available water capacity.
*Real: REB For Eckrant part of REB, see Eckrant series.	Moderate where slopes are 8 to 15 percent and coarse fragments are 35 to 50 percent; clay loam. Severe where slopes are 15 to 45 percent and coarse fragments are 50 to 85 percent.	Moderate where slopes are 8 to 15 percent and coarse fragments are 35 to 50 percent; clay loam. Severe where slopes are 15 to 45 percent and coarse fragments are 50 to 85 percent.	Severe: bedrock at depth of 8 to 20 inches; 35 to 85 percent coarse fragments; 6 to 45 percent slopes.	Moderate where slopes are 8 to 15 percent and coarse fragments are 35 to 50 percent; clay loam. Severe where slopes are 25 to 45 percent and coarse fragments are 50 to 85 percent.	Severe: bedrock at a depth of 8 to 20 inches; seepage.	Severe: 8 to 20 inches of borrow material.	Permeable limestone at a depth of less than 20 inches; low available water capacity; slopes.	Less than 20 inches of borrow material.	Permeable limestone at a depth of less than 20 inches; low available water capacity.
Rehm: RhB	Moderate: clay loam; 20 to 50 percent coarse fragments.	Moderate: clay loam; 20 to 50 percent coarse fragments.	Severe: 20 to 50 percent coarse fragments; 6 to 8 percent slopes in some areas.	Moderate: clay loam; 20 to 50 percent coarse fragments.	Moderate: moderate permeability.	Slight	Low available water capacity; slopes.	20 to 50 percent coarse fragments.	Low available water capacity.
Rock land: RRE. For Real part of RRE, see Real series. Properties too variable to rate.									
Sabenyo: SaC	Moderate: clay loam	Moderate: clay loam	Moderate: clay loam; 1 to 5 percent slopes.	Moderate: clay loam	Severe: seepage	Moderate: medium compressibility; fair to good resistance to piping and erosion.	Slopes	Features generally favorable.	Features generally favorable.
San Saba: Sb, Sc	Severe: clay; very slow permeability.	Severe: clay	Severe: clay; very slow permeability.	Severe: clay	Severe: permeable bedrock at a depth of 24 to 40 inches.	Moderate: fair slope stability.	Limestone at a depth of 24 to 40 inches; moderately well drained; as much as 20 percent stones on the surface.	As much as 20 percent stones on the surface.	As much as 20 percent stones on the surface.
Speck: SpB	Severe: clay	Severe: clay	Severe: clay; bedrock at a depth of 14 to 20 inches.	Severe: clay	Severe: bedrock at a depth of 14 to 20 inches.	Severe: 14 to 20 inches of borrow material.	Limestone at a depth of less than 20 inches; low available water capacity; slopes.	Less than 20 inches of borrow material.	Limestone at a depth of less than 20 inches; low available water capacity.
Tobosa: ToA, ToB	Severe: clay; very slow permeability.	Severe: clay	Severe: clay; very slow permeability.	Severe: clay	Slight	Moderate: fair slope stability; high compressibility.	Moderately well drained.	Features generally favorable.	Features generally favorable.
Topia: TpB	Severe: clay; very slow permeability.	Severe: clay	Severe: clay; very slow permeability.	Severe: clay	Severe: seepage	Moderate: fair slope stability; high compressibility.	Permeable limestone at a depth of 21 to 40 inches.	Features generally favorable.	Features generally favorable.
Uvalde: UvA, UvB	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: silty clay loam.	Moderate: silty clay loam.	Severe: seepage	Moderate: medium compressibility; fair to good resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.

TABLE 5.—*Interpretations of engineering properties of the soils for use in farming and recreation*—Continued

Soil series and map symbols	Degree of limitation and features affecting—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Valco: VaB	Moderate: clay loam	Moderate: clay loam	Moderate: clay loam	Moderate: clay loam
Voleate: VoA, VoB	Moderate: clay loam; moderately slow permeability.	Moderate: clay loam	Moderate: clay loam; moderately slow permeability.	Moderate: clay loam
Webb: WeA, WeB	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability; 2 to 3 percent slopes in some areas.	Slight
Yologo Mapped only with Hindes soils.	Moderate where coarse fragments are 20 to 50 percent. Severe where coarse fragments are 50 to 75 percent.	Moderate where coarse fragments are 20 to 50 percent. Severe where coarse fragments are 50 to 75 percent.	Severe: 20 to 75 percent coarse fragments.	Moderate where coarse fragments are 20 to 50 percent. Severe where coarse fragments are 50 to 75 percent.
Zapata: Za	Severe: indurated caliche at a depth of 3 to 10 inches.	Slight where coarse fragments are 1 to 20 percent. Moderate where coarse fragments are 20 to 25 percent.	Severe: indurated caliche at a depth of 3 to 10 inches; 20 to 25 percent coarse fragments.	Slight where coarse fragments are 1 to 20 percent. Moderate where coarse fragments are 20 to 25 percent.
Zavco: ZcA, ZcB	Moderate: sandy clay loam; moderately slow permeability.	Moderate: sandy clay loam.	Moderate: sandy clay loam; moderately slow permeability.	Moderate: sandy clay loam.

Degree of limitation and features affecting—Continued		Soil features affecting—		
Ponds		Irrigation	Terraces and diversions	Grassed waterways
Reservoir areas	Embankments			
Severe: strongly cemented caliche at a depth of 13 to 20 inches.	Severe: 13 to 20 inches of borrow material.	Strongly cemented caliche at a depth of 13 to 20 inches; low available water capacity.	13 to 20 inches of borrow material.	Strongly cemented caliche at a depth of 13 to 20 inches; low available water capacity.
Moderate: moderately slow permeability.	Moderate: fair slope stability; high compressibility.	Features generally favorable.	Features generally favorable.	Features generally favorable.
Moderate: moderately slow permeability.	Moderate: medium compressibility; fair to good resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.
Severe: strongly cemented caliche at a depth of 8 to 19 inches; seepage.	Severe: 8 to 19 inches of borrow material.	Indurated caliche at a depth of 8 to 19 inches; low available water capacity.	8 to 19 inches of borrow material.	Indurated caliche at a depth of 8 to 19 inches; low available water capacity.
Severe: indurated caliche at a depth of 3 to 10 inches; seepage.	Severe: 3 to 10 inches of borrow material.	Indurated caliche at a depth of 3 to 10 inches; low available water capacity.	3 to 10 inches of borrow material.	Indurated caliche at a depth of 3 to 10 inches; low available water capacity.
Moderate: moderately slow permeability.	Moderate: medium compressibility; fair to good resistance to piping and erosion.	Features generally favorable.	Features generally favorable.	Features generally favorable.

TABLE 6.—*Interpretations of engineering properties of the soils for use in town and country planning*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties nd limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series in the first column of this table]

Soil series and map symbols	Suitability as source of, and properties affecting use for—			Degree of limitation and features affecting—				
	Topsoil [1]	Sand and gravel	Road fill	Roads and streets	Foundations for low buildings	Light industry	Sewage disposal	
							Septic tank filter fields	Sewage lagoons
Ateo: AtA, AtB	Poor: excess lime	Improbable source	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Moderate: high corrosivity.	Slight	Moderate: moderate permeability.
Badland: Bd. Properties too variable to rate.								
Bosque loam, coarse subsoil variant: Bo.	Poor: excess lime	Improbable source	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Moderate: subject to flooding.	Moderate: moderate permeability.
*Brackett: BRB, BRE For Real part of BRB and BRE, see Real series.	Poor: excess lime	Improbable source	Fair: fair traffic-supporting capacity.	Moderate where slopes are 2 to 15 percent; fair traffic-supporting capacity. Severe where slopes are 15 to 30 percent.	Moderate where slopes are 2 to 15 percent. Severe where slopes are more than 15 percent.	Severe: slopes are 8 to 30 percent in some areas.	Severe: moderately slow permeability.	Severe: permeable substrata.
Caid: CaA, CaB	Fair: sandy clay loam surface layer.	Improbable source	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Moderate: high corrosivity.	Slight	Moderate: moderate permeability.
Castroville: CcA, CcB	Fair: clay loam surface layer	Improbable source	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Moderate: high corrosivity.	Slight	Moderate: moderate permeability.
Comitas fine sand, sandy subsoil variant: Cm.	Poor: fine sand surface layer	Fair for sand; contains excessive fines that need to be washed out. Improbable source for gravel.	Fair: fair traffic-supporting capacity.	Slight	Slight	Slight	Slight	Severe: moderately rapid permeability.
Conalb: Co	Poor: excess lime	Poor: thick overburden; excessive fines.	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity; subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.
*Dant: DaA, DaB For Uvalde part of DaA and DaB, see Uvalde series.	Fair: clay loam surface layer	Improbable source	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.
Dev: De	Poor: 10 to 80 percent coarse fragments; excess lime.	Improbable source for sand. Fair to good source for gravel; excessive fines.	Good	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: moderately rapid permeability.
Duval: DuB	Good	Improbable source	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight	Moderate: high corrosivity.	Slight	Moderate: 1 to 3 percent slopes; moderate permeability.
*Eckrant: ECB, EkC For Kavett part of EkC, see Kavett series.	Poor: 35 to 85 percent coarse fragments; gravelly clay surface layer.	Improbable source	Poor: 4 to 20 inches of material; high shrink-swell potential; poor traffic-supporting capacity.	Severe: bedrock at a depth of 4 to 20 inches; high shrink-swell potential; poor traffic-supporting capacity.	Severe: bedrock at a depth of 4 to 20 inches; high shrink-swell potential.	Severe: bedrock at a depth of 4 to 20 inches; high shrink-swell potential.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.
Ector: ECB, ERE	Poor: 35 to 75 percent coarse fragments.	Improbable source	Poor: 4 to 19 inches of material.	Severe: bedrock at a depth of 4 to 19 inches.	Severe: bedrock at a depth of 4 to 19 inches.	Severe: bedrock at a depth of 4 to 19 inches.	Severe: bedrock at a depth of 4 to 19 inches.	Severe: bedrock at a depth of 4 to 19 inches.
Frio: FoA, FoB, Fs	Fair: silty clay loam surface layer.	Improbable source	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate where flooding is infrequent; moderate shrink-swell potential; fair traffic-supporting capacity. Severe where flooding is frequent.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: moderately slow permeability; subject to flooding.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.

See footnotes at end of table.

TABLE 6.—*Interpretations of engineering properties of the soils for use in town and country planning*—Continued

Soil series and map symbols	Suitability as source of, and properties affecting use for—			Degree of limitation and features affecting—				
	Topsoil [1]	Sand and gravel	Road fill	Roads and streets	Foundations for low buildings	Light industry	Sewage disposal	
							Septic tank filter fields	Sewage lagoons
*Hindes: HYB. For Yologo part of HYB, see Yologo series.	Poor: 10 to 50 percent coarse fragments.	Improbable source for sand. Poor source for gravel; excessive fines.	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Moderate: high corrosivity.	Severe: moderately slow permeability.	Slight where slopes are 1 to 2 percent and coarse fragments are 10 to 20 percent. Moderate where slopes are 2 to 7 percent and coarse fragments are 20 to 50 percent. Severe where slopes are 7 to 8 percent.
Ingram: IgC, InD	Poor: clay surface layer; 15 to 70 percent coarse fragments.	Improbable source	Poor: 15 to 70 percent coarse fragments; high shrink-swell potential; poor traffic-supporting capacity.	Severe: 15 to 70 percent coarse fragments; high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: bedrock at a depth of 20 to 48 inches; slow permeability.	Severe: bedrock at a depth of 20 to 40 inches; 15 to 70 percent coarse fragments; slopes.
Kavett: KaB	Poor: clay surface layer	Improbable source	Poor: 13 to 20 inches of material; high shrink-swell potential; poor traffic-supporting capacity.	Severe: bedrock at a depth of 13 to 20 inches; high shrink-swell potential; poor traffic-supporting capacity.	Severe: bedrock at a depth of 13 to 20 inches; high shrink-swell potential.	Severe: bedrock at a depth of 13 to 20 inches; high shrink-swell potential.	Severe: bedrock at a depth of 13 to 20 inches; moderately slow permeability.	Severe: bedrock at a depth of 13 to 20 inches.
Knippa: KnA, KnB	Poor: clay surface layer	Improbable source	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.
Limestone rock land: LS. Properties too variable to rate.								
Mercedes: Me	Poor: clay surface layer	Improbable source	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight.
Montell: MoA, MoB	Poor: clay surface layer	Improbable source	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential	Severe: high shrink-swell potential	Severe: very slow permeability	Slight.
*Olmos: OLB, OMB. For Ector part of OMB, see Ector series.	Poor: 35 to 75 percent coarse fragments.	Improbable source for sand. Poor source for gravel; caliche fragments and excessive fines.	Good	Moderate: rippable, indurated caliche at a depth of 7 to 20 inches.	Moderate: rippable, indurated caliche at a depth of 7 to 20 inches.	Moderate: indurated caliche at a depth of 7 to 20 inches; high corrosivity.	Severe: indurated caliche at a depth of 7 to 20 inches. [2]	Severe: indurated caliche at a depth of 7 to 20 inches.
Orif: Or	Poor: 10 to 25 percent coarse fragments.	Fair to good source for sand; mainly carbonate; excessive coarse fragments. Fair to good source for gravel; mainly limestone material.	Good	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: subject to flooding.	Severe: rapid permeability.
Pratley: PrB	Poor: clay surface layer	Improbable source	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: moderately slow permeability.	Severe: indurated caliche at a depth of 22 to 40 inches.
Ramadero: Ra	Fair: sandy clay loam surface layer.	Improbable source	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Severe: subject to flooding.	Severe: subject to flooding.	Slight	Moderate: moderate permeability.
Randado: RdB	Fair where surface layer is 6 to 10 inches of fine sandy loam. Severe where surface layer is 5 to 6 inches of fine sandy loam.	Improbable source	Good	Moderate: fair traffic-supporting capacity.	Moderate: indurated caliche at a depth of 12 to 20 inches.	Moderate: indurated caliche at a depth of 12 to 20 inches.	Severe: indurated caliche at a depth of 12 to 20 inches. [2]	Severe: indurated caliche at a depth of 12 to 20 inches.

See footnotes at end of table.

TABLE 6.—*Interpretations of engineering properties of the soils for use in town and country planning*—Continued

Soil series and map symbols	Suitability as source of, and properties affecting use for—			Degree of limitation and features affecting—				
	Topsoil [1]	Sand and gravel	Road fill	Roads and streets	Foundations for low buildings	Light industry	Sewage disposal	
							Septic tank filter fields	Sewage lagoons
*Real: REB..... For Eckrant part of REB, see Eckrant series.	Poor: 35 to 85 percent coarse fragments.	Improbable source.....	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate where slopes are 6 to 15 percent; moderate shrink-swell potential; fair traffic-supporting capacity. Severe where slopes are 15 to 45 percent.	Moderate where slopes are 6 to 15 percent; moderate shrink-swell potential. Severe where slopes are 15 to 45 percent.	Severe: 8 to 45 percent slopes.	Severe: bedrock at a depth of 8 to 20 inches; 10 to 45 percent slopes.	Severe: bedrock at a depth of 8 to 20 inches; 7 to 45 percent slopes.
Rehm: RhB.....	Poor: 20 to 50 percent coarse fragments.	Improbable source for sand..... Poor source for gravel; excessive fines.	Fair: fair traffic-supporting capacity.	Slight.....	Slight.....	Moderate: high corrosivity.	Moderate: moderate permeability.	Moderate where slopes are 2 to 7 percent; moderate permeability. Severe where slopes are 7 to 8 percent.
*Rock land: RRE. For Real part of RRE, see Real series. Properties too variable to rate.								
Sabenyo: SaC.....	Poor: excess lime.....	Improbable source.....	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight.....	Moderate: high corrosivity.	Slight.....	Moderate: moderate permeability.
San Saba: Sb, Sc.....	Poor: clay surface layer.....	Improbable source.....	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: bedrock at a depth of 24 to 40 inches; very slow permeability.	Severe: bedrock at a depth of 24 to 40 inches.
Speck: SpB.....	Poor: clay surface layer.....	Improbable source.....	Poor: 14 to 20 inches of material; poor traffic-supporting capacity.	Severe: bedrock at a depth of 14 to 20 inches; poor traffic-supporting capacity.	Severe: bedrock at a depth of 14 to 20 inches.	Severe: bedrock at a depth of 14 to 20 inches.	Severe: bedrock at a depth of 14 to 20 inches; slow permeability.	Severe: bedrock at a depth of 14 to 20 inches.
Tobosa: ToA, ToB.....	Poor: clay surface layer.....	Improbable source.....	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.
Topia: TpB.....	Poor: clay surface layer.....	Improbable source.....	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: very slow permeability.	Severe: seepage.
Uvalde: UvA, UvB.....	Fair: silty clay loam surface layer.	Improbable source.....	Fair: fair traffic-supporting capacity.	Moderate: fair traffic-supporting capacity.	Slight.....	Moderate: high corrosivity.	Slight.....	Moderate: moderate permeability.
Valco: VaB.....	Fair: clay loam surface layer...	Improbable source.....	Fair: fair traffic-supporting capacity.	Moderate: rippable caliche at a depth of 13 to 20 inches; fair traffic-supporting capacity.	Moderate: rippable caliche at a depth of 13 to 20 inches.	Moderate: rippable caliche at a depth of 13 to 20 inches; high corrosivity.	Severe: strongly cemented caliche at a depth of 13 to 20 inches.[1]	Severe: strongly cemented caliche at a depth of 13 to 20 inches.
Volente: VoA, VoB.....	Fair: clay loam surface layer...	Improbable source.....	Poor: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential; poor traffic-supporting capacity.	Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.
Webb: WeA, WeB.....	Fair: 7 to 18 inches of fine sandy loam.	Improbable source.....	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Moderate: high corrosivity; moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight where bedrock is at a depth of 40 to 60 inches and slopes are 0 to 2 percent. Moderate where bedrock is at a depth of 40 to 60 inches and slopes are 2 to 3 percent. Severe where bedrock is at a depth of 36 to 40 inches.

TABLE 6.—*Interpretations of engineering properties of the soils for use in town and country planning*—Continued

Soil series and map symbols	Suitability as source of, and properties affecting use for—			Degree of limitation and features affecting—				
	Topsoil [1]	Sand and gravel	Road fill	Roads and streets	Foundations for low buildings	Light industry	Sewage disposal	
							Septic tank filter fields	Sewage lagoons
*Yologo Mapped only with Hindes soils.	Poor: 20 to 75 percent coarse fragments.	Improbable source for sand. Poor source for gravel: excessive fines.	Fair: fair traffic-supporting capacity.	Moderate: rippable caliche at a depth of 8 to 19 inches.	Moderate: rippable caliche at a depth of 8 to 19 inches.	Moderate: rippable caliche at a depth of 8 to 19 inches; high corrosivity.	Severe: indurated caliche at a depth of 8 to 19 inches.[2]	Severe: indurated caliche at a depth of 8 to 19 inches; seepage.
Zapata: Za	Poor: 3 to 6 inches of loam; excess lime.	Improbable source	Good	Moderate: indurated caliche at a depth of 3 to 10 inches; fair traffic- supporting capacity.	Moderate: indurated, rippable caliche at a depth of 3 to 10 inches.	Moderate: indurated, rippable caliche at a depth of 3 to 10 inches.	Severe: indurated, rippable caliche at a depth of 3 to 10 inches.[2]	Severe: indurated caliche at a depth of 3 to 10 inches; seepage.
Zavco: ZcA, ZcB	Fair: sandy clay loam surface layer.	Improbable source	Fair: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential; fair traffic-supporting capacity.	Moderate: moderate shrink-swell potential.	Moderate: high corrosivity.	Severe: moderately slow permeability.	Slight where slopes are 0 to 2 percent. Moderate where slopes are 2 to 3 percent.

[1] Ratings refer to the surface layer.

[2] Where filter field tile can be installed below the indurated caliche, the rating is moderate.

TABLE 7.—*Engineering test data*

(Tests performed by Texas Highway Department in accordance with standard procedures of the American Association of State Highway Officials (AASHO))

Soil name and location	Parent material	Texas report number	Depth from surface	Shrinkage			Mechanical analysis[1]										Liquid limit	Plasticity index	Classification	
				Limit	Ratio	Linear	Percentage passing sieve—						Percentage smaller than—							
							1 inch	½ inch	¼ inch	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.			AASHO [2]	Unified [3]
			Inches	*Percent*		*Percent*											*Percent*			
Knippa clay: 3.9 miles east of Knippa, on U.S. Highway 90 and 0.1 mile north of U.S. Highway 90. (Modal)	Calcareous clayey and loamy sediment.	64-440-S	6-17	15	1.90	17.6				100	99	98	92	68	37	46	58	33	A-7-6(19)	CH
		64-441-S	26-40	14	1.89	17.7			100	99	99	97	92	80	64	58	55	33	A-7-6(19)	CH
		64-442-S	40-72	13	1.96	14.7	100	99	97	93	87	76	74	72	52	35	44	27	A-7-6(14)	CL
Knippa clay: 4.2 miles north of Knippa, on Farm Road 1049 and 150 feet west of Farm Road 1049. (More clayey than modal)	Calcareous clayey and loamy sediment.	64-443-S	7-18	11	1.98	21.5				100	99	95	92	69	45	58	68	41	A-7-6(20)	CH
		64-444-S	18-42	11	1.96	19.4			100	99	99	94	91	68	54	45	57	35	A-7-6(17)	CH
		64-445-S	42-72	14	1.96	13.3			100	98	89	82	78	77	58	48	48	30	A-7-6(16)	CL
Knippa clay: 5 miles northeast of Knippa. (Less clayey than modal)	Calcareous clayey and loamy sediment.	64-446-S	6-16	13	1.93	17.9			100	99	99	96	87	79	57	45	54	34	A-7-6(19)	CH
		64-447-S	16-28	13	1.95	17.2				100	99	96	88	67	39	45	58	29	A-7-6(18)	CH
		64-448-S	28-60	13	1.92	15.0		100	94	90	85	81	73	71	51	35	40	16	A-6(13)	CL
Montell clay: 1 miles northwest of Uvalde. (Modal)	Calcareous clayey sediment.	64-429-S	8-22	9	2.02	28.5				100	99	97	97	89	85	71	89	48	A-7-6(20)	CH
		64-430-S	22-34	11	2.02	21.9					100	99	95	93	71	58	62	42	A-7-6(20)	CH
		64-431-S	34-72	9	2.04	21.4					100	99	95	92	69	57	61	43	A-7-6(20)	CH
Montell clay: 3.2 miles west of the courthouse in Uvalde and 2.25 miles north of U.S. Highway 90 and 150 feet west of Farm Road 2369. (More clayey than modal).	Calcareous clayey sediment.	64-432-S	8-30	9	2.04	23.7				100	99	95	89	68	37	49	69	38	A-7-6(20)	CH
		64-433-S	30-54	11	2.01	22.5				100	99	96	92	78	48	72	72	31	A-7-6(20)	CH
		64-434-S	54-72	11	2.01	23.3				100	99	96	93	72	42	71	70	30	A-7-6(20)	CH
Montell clay: 1 miles northwest of Uvalde. (Less clayey than Modal)	Calcareous clayey sediment.	64-435-S	7-33	11	2.00	19.4				100	99	96	86	62	40	52	51	25	A-7-6(19)	CH
		64-436-S	33-49	11	2.02	19.6				100	99	94	89	67	43	56	59	29	A-7-6(19)	CH
Uvalde silty clay loam: 1.3 mi.....'s of Knippa on Farm Road 1049 and 200 feet west of Farm Road 1049. (Modal)	Calcareous clayey and loamy sediment.	64-449-S	8-16	13	1.96	13.4				100	99	96	91	63	31	37	42	23	A-7-6(14)	CL
		64-450-S	16-33	13	1.96	12.4				100	99	95	89	54	23	40	41	23	A-7-6(12)	CL
		64-451-S	33-59	13	1.83	8.8			100	99	99	93	83	56	29	19	32	13	A-6(10)	CL
Uvalde silty clay loam: 1.4 miles south of the courthouse and 1.6 miles southeast of junction of Farm Road 117 and 140 and 1.1 miles southwest of Farm Road 140 and 100 feet north of cemetery. (Less clayey than Modal)	Calcareous clayey and loamy sediment.	64-452-S	8-16	13	1.91	12.4				100	99	96	93	73	39	29	42	22	A-7-6(12)	CL
		64-453-S	16-29	13	1.84	13.4				100	99	96	93	77	47	39	44	22	A-7-6(13)	CL
		64-457-S	29-56	16	1.82	12.4			100	99	99	96	90	86	60	44	43	21	A-7-6(11)	CL

[1] Mechanical analyses according to the AASHO Designation T 88 (2). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis used in this table are not suitable for use in naming textural classes for soil.

[2] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 6): The Classification of Soils and Soil-aggregate Mixtures for Highway Construction Purposes, AASHO Designation M 145–49 (2).

[3] Based on the Unified Soil Classification System, Technical Memorandum No. 3–357, Volume 1, Waterways Experiment Station, Corps of Engineers, March 1953.

TABLE 8.—*Classification of soil series*

Series	Family	Subgroup	Order
Atco	Coarse-loamy, carbonatic, hyperthermic	Aridic Ustochrepts	Inceptisols.
Bosque loam, coarse subsoil variant.	Coarse-loamy, carbonatic, thermic	Cumulic Haplustolls	Mollisols.
Brackett	Loamy, carbonatic, thermic, shallow	Typic Ustochrepts	Inceptisols.
Caid	Fine-loamy, mixed, hyperthermic	Aridic Paleustolls	Mollisols.
Castroville	Fine-silty, mixed, hyperthermic	Typic Calciustolls	Mollisols.
Comitas fine sand, sandy subsoil variant.	Sandy, mixed, hyperthermic	Arenic Aridic Paleustalfs	Alfisols.
Conalb	Fine-loamy, carbonatic, hyperthermic	Fluventic Ustochrepts	Inceptisols.
Dant	Fine, montmor illonitic, hyperthermic	Torrertic Haplustolls	Mollisols.
Dev	Loamy-skeletal, carbonatic, thermic	Cumulic Haplustolls	Mollisols.
Duval	Fine-loamy, mixed, hyperthermic	Aridic Haplustalfs	Alfisols.
Eckrant	Clayey-skeletal, montmorillonitic, thermic	Lithic Haplustolls	Mollisols.
Ector	Loamy-skeletal, carbonatic, thermic	Lithic Calciustolls	Mollisols.
Frio [1]	Fine, mixed, thermic	Cumulic Haplustolls	Mollisols.
Hindes	Clayey-skeletal, mixed, hyperthermic	Aridic Argiustolls	Mollisols.
Ingram	Fine, mixed, hyperthermic	Torrertic Haplustolls	Mollisols.
Kavett	Clayey, montmorillonitic, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Knippa	Fine, mixed, thermic	Vertic Calciustolls	Mollisols.
Mercedes	Fine, montmorillonitic, hyperthermic	Udorthentic Pellusterts	Vertisols.
Montell	Fine, montmorillonitic, hyperthermic	Entic Pellusterts	Vertisols.
Olmos	Loamy-skeletal, carbonatic, hyperthermic, shallow.	Paleorthidic Calciustolls	Mollisols.
Orif	Sandy-skeletal, carbonatic, thermic	Typic Ustifluvents	Entisols.
Pratley	Fine, montmorillonitic, thermic	Petrocalcic Paleustolls	Mollisols.
Ramadero	Fine-loamy, mixed, hyperthermic	Pachic Argiustolls	Mollisols.
Randado	Loamy, mixed, hyperthermic, shallow	Petrocalcic Ustollic Paleargids	Aridisols.
Real	Loamy-skeletal, carbonatic, thermic, shallow	Typic Calciustolls	Mollisols.
Rehm	Loamy-skeletal, mixed, hyperthermic	Aridic Calciustolls	Mollisols.
Sabenyo	Fine-loamy, carbonatic, hyperthermic	Aridic Ustochrepts	Inceptisols.
San Saba	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Speck	Clayey, mixed, thermic	Lithic Argiustolls	Mollisols.
Tobosa [1]	Fine, montmorillonitic, thermic	Typic Chromusterts	Vertisols.
Topia	Very fine, mixed, thermic	Vertic Argiustolls	Mollisols.
Uvalde	Fine-silty, mixed, hyperthermic	Aridic Calciustolls	Mollisols.
Valco	Loamy, mixed, hyperthermic, shallow	Petrocalcic Calciustolls	Mollisols.
Volente	Fine, mixed, thermic	Pachic Haplustolls	Mollisols.
Webb [2]	Fine, mixed, hyperthermic	Aridic Haplustalfs	Alfisols.
Yologo	Loamy-skeletal, mixed, hyperthermic, shallow	Petrocalcic Paleustolls	Mollisols.
Zapata	Loamy, carbonatic, hyperthermic, shallow	Ustollic Paleorthids	Aridisols.
Zavco	Fine, mixed, hyperthermic	Aridic Argiustolls	Mollisols.

[1] Some of the Frio and Tobosa soils in Uvalde County are taxadjuncts to the Frio and Tobosa series in that the mean annual soil temperature is slightly more than 72° F. This difference does not affect use and management.

[2] Some of the Webb soils in Uvalde County are taxadjuncts to the Webb series in that they have a solum thinner than 40 inches. This difference does not alter use and management.

TABLE 9.—*Temperature and precipitation data*

[Period of record 1932–62]

Month	Temperature			Precipitation	
	Average daily maximum	Average daily minimum	Average daily	Average total	Average number of days that have precipitation of 0.5 inch or more
	°F.	°F.	°F.	Inches	
January	65.3	39.0	52.2	1.25	(1)
February	69.7	43.1	56.4	1.34	1
March	77.1	48.7	62.9	1.12	1
April	84.0	56.4	70.2	1.74	1
May	89.7	64.9	77.3	3.26	3
June	95.6	70.9	83.2	2.73	2
July	97.8	72.1	85.0	2.59	1
August	98.5	71.7	85.1	2.25	2
September	91.8	67.1	79.4	2.82	1
October	85.1	58.2	71.6	2.51	2
November	73.1	45.7	59.4	0.86	1
December	66.6	39.8	53.2	1.23	(1)
Year			69.7	23.70	15

[1] Less than one-half day.

TABLE 10.—*Probabilities of selected temperature limits occurring on or before dates shown*

[Period of record 1932–62]

Temperature	Probability		
	1 year in 2	3 years in 4	9 years in 10
Spring:			
°F			
32 or lower	March 8	March 21	April 2.
38 or lower	March 31	April 9	April 18.
50 or lower	April 23	May 2	May 9.
50 average or lower.	March 14	March 24	April 2.
55 average or lower.	March 28	April 8	April 18.
60 average or higher.	March 12	March 24	April 5.
65 average or higher.	March 14	March 25	April 5.
70 average or higher.	March 18	March 29	April 9.
75 average or higher.	March 29	April 10	April 20.
80 average or higher.	April 25	May 6	May 16.
85 average or higher.	May 28	June 6	June 15.
Fall:			
60 or lower	September 17	September 27	October 6.
50 or lower	October 15	October 26	November 6.
38 or lower	November 3	November 12	November 20.
32 or lower	November 19	November 28	December 7.

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

UVALDE COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

N

SOIL ASSOCIATIONS *

1 Uvalde-Knippa-Montell association: Nearly level to gently sloping, deep loamy and clayey soils

2 Rock land-Real-Eckrant association: Exposed limestone bedrock and nearly level to gently sloping and undulating to steep, shallow to very shallow and gravelly, loamy and clayey soils

3 Ector-Eckrant-Speck association: Nearly level to gently sloping and undulating to hilly, very shallow to shallow and stony, clayey and loamy soils

4 Olmos-Ector association: Undulating, shallow and very shallow and stony and gravelly, loamy soils

5 Hindes-Yologo-Olmos association: Undulating, deep to very shallow gravelly loamy soils

6 Webb-Zavco-Duval association: Nearly level to gently sloping, deep loamy soils

* Texture terms refer to the surface layer of the major soils in each soil association.

Compiled 1973

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. The suitability of the soils for use as cropland is described in the soil descriptions. The capability classification system is described on pages 50 to 53. Other information is given in tables as follows:

Acreage and extent, table 1, page 8.
Estimated yields, table 2, page 56.
Interpretations of the soils for wildlife habitat, table 3, page 66.
Engineering properties and uses of the soils, tables 4, 5, 6, and 7, pages 70 through 93.

Map symbol	Mapping unit	Page	Capability unit: Dryland	Capability unit: Irrigated	Pasture and hayland group	Range site	Page
AtA	Atco loam, 0 to 1 percent slopes	9	IIIs-1	IIs-1	7C	High Lime	60
AtB	Atco loam, 1 to 3 percent slopes	9	IIIe-1	IIe-1	7C	High Lime	60
Bd	Badland	9	VIIe-1	------	------	----------	---
Bo	Bosque loam, coarse subsoil variant	10	IIIc-1	I-1	2A	Loamy Bottomland	60
BRB	Brackett and Real soils, undulating	11	VIs-1	------	------	Adobe	57
BRE	Brackett and Real soils, hilly	11	VIIs-1	------	------	Steep Adobe	63
CaA	Caid sandy clay loam, 0 to 1 percent slopes	13	IIIc-2	I-2	7C	Clay Loam	59
CaB	Caid sandy clay loam, 1 to 3 percent slopes	13	IIIe-2	IIe-2	7C	Clay Loam	59
CcA	Castroville clay loam, 0 to 1 percent slopes	15	IIc-1	I-2	7C	Clay Loam	59
CcB	Castroville clay loam, 1 to 3 percent slopes	15	IIe-1	IIe-2	7C	Clay Loam	59
Cm	Comitas fine sand, sandy subsoil variant	16	IIIe-3	IIIs-1	9A	Sandy Loam 1/	62
Co	Conalb loam	17	IIIc-1	I-1	2A	Loamy Bottomland	60
DaA	Dant and Uvalde soils, 0 to 1 percent slopes	17	------	------	------	Clay Loam	59
	Dant	----	IIIs-2	IIs-2	7A	----------	---
	Uvalde	----	IIIc-2	I-2	7C	----------	---
DaB	Dant and Uvalde soils, 1 to 3 percent slopes	18	------	------	------	Clay Loam	59
	Dant	----	IIIe-4	IIe-3	7A	----------	---
	Uvalde	----	IIIe-2	IIe-2	7C	----------	---
De	Dev soils	19	VIw-1	------	14A	Loamy Bottomland	60
DuB	Duval fine sandy loam, 1 to 3 percent slopes	20	IIIe-5	IIe-4	8C	Sandy Loam	62
ECB	Eckrant soils, undulating	21	VIIs-2	------	------	Low Stony Hill	61
EkC	Eckrant-Kavett complex, 0 to 5 percent slopes	21	VIIs-2	------	------	----------	---
	Eckrant	----	------	------	------	Low Stony Hill	61
	Kavett	----	------	------	------	Shallow (of the Edwards Plateau)	62
EOB	Ector soils, undulating	23	VIIs-2	------	------	Stony Ridge	64
ERE	Ector soils and Rock outcrop, hilly	23	------	------	------	----------	---
	Ector	----	VIIs-2	------	------	Stony Ridge	64
	Rock outcrop	----	VIIIs-2	------	------	----------	---
FoA	Frio silty clay loam, 0 to 1 percent slopes	24	IIc-2	I-1	1C	Loamy Bottomland	60
FoB	Frio silty clay loam, 1 to 3 percent slopes	25	IIe-2	IIe-5	1C	Loamy Bottomland	60
Fs	Frio silty clay loam, frequently flooded	25	Vw-1	Vw-1	1C	Loamy Bottomland	60
HYB	Hindes and Yologo soils, undulating	26	------	------	------	Gravelly Ridge	59
	Hindes	----	VIs-2	------	------	----------	---
	Yologo	----	VIIs-3	------	------	----------	---
IgC	Ingram gravelly soils, 0 to 5 percent slopes	27	VIIs-4	------	------	Igneous Hill	60
InD	Ingram stony soils, hilly	27	VIIs-4	------	------	Igneous Hill	60
KaB	Kavett clay, 0 to 3 percent slopes	28	IIIe-6	IIIe-1	13A	Shallow (of the Edwards Plateau)	62
KnA	Knippa clay, 0 to 1 percent slopes	28	IIs-1	IIs-2	7C	Clay Loam	59
KnB	Knippa clay, 1 to 3 percent slopes	29	IIe-3	IIe-2	7C	Clay Loam	59
LS	Limestone rock land	29	VIIIs-1	------	------	Rocky Hill	61
Me	Mercedes clay	30	IVw-1	IVw-1	7A	Clay Flat	58
MoA	Montell clay, 0 to 1 percent slopes	31	IVs-1	IIs-3	7A	Clay Flat	58
MoB	Montell clay, 1 to 3 percent slopes	32	IVe-1	IIIe-2	7A	Clay Flat	58
OLB	Olmos soils, undulating	33	VIIs-5	------	------	Shallow Ridge	63
OMB	Olmos and Ector soils, undulating	33	------	------	------	Shallow Ridge	63
	Olmos	----	VIIs-5	------	------	----------	---
	Ector	----	VIIs-2	------	------	----------	---
Or	Orif soils	34	VIw-1	------	------	Loamy Bottomland	60
PrB	Pratley clay, 0 to 3 percent slopes	35	IIe-3	IIe-2	7C	Deep Upland	59
Ra	Ramadero sandy clay loam	36	IIc-3	I-2	7C	Ramadero	61
RdB	Randado fine sandy loam, 1 to 3 percent slopes	36	IVe-2	IIe-6	14A	Shallow Sandy Loam	63
REB	Real and Eckrant soils, undulating	37	------	------	------	----------	---
	Real	----	VIs-1	------	------	Adobe	57
	Eckrant	----	VIIs-2	------	------	Low Stony Hill	61
RhB	Rehm soils, undulating	38	VIs-2	------	------	Shallow (of the Rio Grande Plain)	63
RRE	Rock land-Real association, steep	38	------	------	------	----------	---
	Rock land	----	VIIIs-2	------	------	Steep Rocky	64
	Real	----	VIIs-2	------	------	Steep Adobe	63
SaC	Sabenyo clay loam, 1 to 5 percent slopes	39	IVe-3	IIe-7	13A	Shallow (of the Rio Grande Plain)	63
Sb	San Saba clay	40	IIIs-3	IIs-3	7A	Deep Upland	59
Sc	San Saba stony clay	40	VIs-4	------	------	Deep Upland	59
SpB	Speck soils, undulating	41	VIs-3	------	------	Redland	61
ToA	Tobosa clay, 0 to 1 percent slopes	41	IVs-1	IIs-3	7A	Deep Upland	59
ToB	Tobosa clay, 1 to 3 percent slopes	42	IVe-1	IIIe-2	7A	Deep Upland	59
TpB	Topia clay, 0 to 3 percent slopes	43	IIIe-7	IIIe-2	7A	Redland	61
UvA	Uvalde silty clay loam, 0 to 1 percent slopes	44	IIIc-2	I-2	7C	Clay Loam	59
UvB	Uvalde silty clay loam, 1 to 3 percent slopes	44	IIIe-2	IIe-2	7C	Clay Loam	59
VaB	Valco clay loam, 0 to 3 percent slopes	45	IVs-2	IIIe-1	13A	Shallow (of the Rio Grande Plain)	63
VoA	Volente clay loam, 0 to 1 percent slopes	45	IIc-1	I-2	7C	Deep Upland	59
VoB	Volente clay loam, 1 to 3 percent slopes	46	IIe-1	IIe-2	7C	Deep Upland	59
WeA	Webb fine sandy loam, 0 to 1 percent slopes	46	IIIc-3	I-3	8A	Tight Sandy Loam	64
WeB	Webb fine sandy loam, 1 to 3 percent slopes	47	IIIe-8	IIe-8	8A	Tight Sandy Loam	64
Za	Zapata soils	48	VIIs-5	------	------	Shallow Ridge	63
ZcA	Zavco sandy clay loam, 0 to 1 percent slopes	48	IIIc-2	I-2	7C	Clay Loam	59
ZcB	Zavco sandy clay loam, 1 to 3 percent slopes	49	IIIe-2	IIe-2	7C	Clay Loam	59

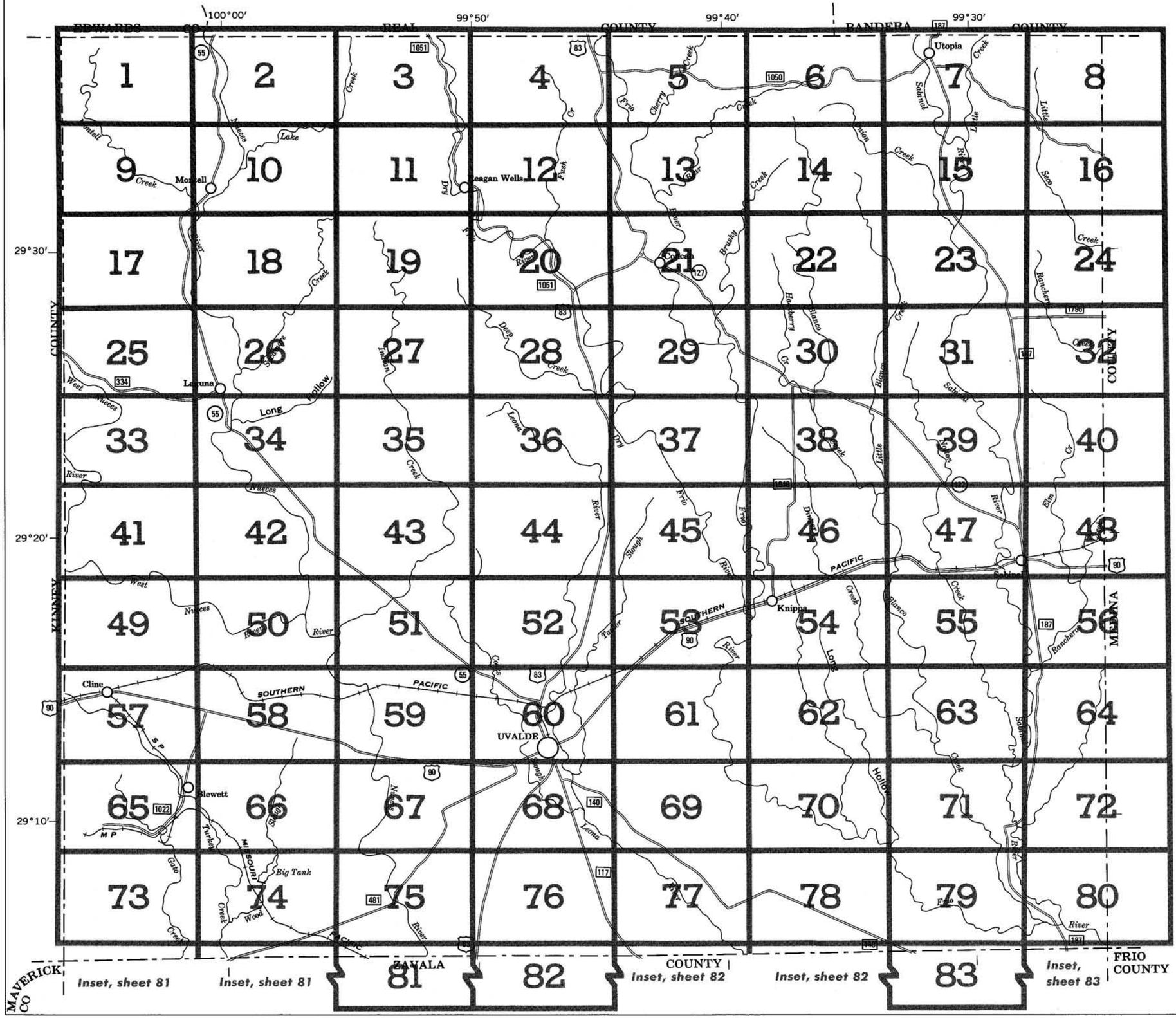
1/ Due to very small acreage, this soil is included in Sandy Loam Range Site.

INDEX TO MAP SHEETS
UVALDE COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

N



UVALDE CO. TEXAS 27228

SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, or E, shows the slope. Most symbols without a slope letter are those for nearly level soils, but some are for soils and land types that have a considerable range of slope.

SYMBOL	NAME
	Medium Intensity
AtA	Atco loam, 0 to 1 percent slopes
AtB	Atco loam, 1 to 3 percent slopes
Bd	Badland
Bo	Bosque loam, coarse subsoil variant
CaA	Caid sandy clay loam, 0 to 1 percent slopes
CaB	Caid sandy clay loam, 1 to 3 percent slopes
CcA	Castroville clay loam, 0 to 1 percent slopes
CcB	Castroville clay loam, 1 to 3 percent slopes
Cm	Comitas fine sand, sandy subsoil variant
Co	Conalb loam
DaA	Dant and Uvalde soils, 0 to 1 percent slopes
DaB	Dant and Uvalde soils, 1 to 3 percent slopes
De	Dev soils
DuB	Duval fine sandy loam, 1 to 3 percent slopes
EkC	Eckrant-Kavett complex, 0 to 5 percent slopes
FoA	Frio silty clay loam, 0 to 1 percent slopes
FoB	Frio silty clay loam, 1 to 3 percent slopes
Fs	Frio silty clay loam, frequently flooded
IgC	Ingram gravelly soils, 0 to 5 percent slopes
InD	Ingram stony soils, hilly
KaB	Kavett clay, 0 to 3 percent slopes
KnA	Knippa clay, 0 to 1 percent slopes
KnB	Knippa clay, 1 to 3 percent slopes
Me	Mercedes clay
MoA	Montell clay, 0 to 1 percent slopes
MoB	Montell clay, 1 to 3 percent slopes
Or	Orif soils
PrB	Pratley clay, 0 to 3 percent slopes
Ra	Ramadero sandy clay loam
RdB	Randado fine sandy loam, 1 to 3 percent slopes
RhB	Rehm soils, undulating
SaC	Sabenyo clay loam, 1 to 5 percent slopes
Sb	San Saba clay
Sc	San Saba stony clay
SpB	Speck soils, undulating
ToA	Tobosa clay, 0 to 1 percent slopes
ToB	Tobosa clay, 1 to 3 percent slopes
TpB	Topia clay, 0 to 3 percent slopes
UvA	Uvalde silty clay loam, 0 to 1 percent slopes
UvB	Uvalde silty clay loam, 1 to 3 percent slopes
VaB	Valco clay loam, 0 to 3 percent slopes
VoA	Volente clay loam, 0 to 1 percent slopes
VoB	Volente clay loam, 1 to 3 percent slopes
WeA	Webb fine sandy loam, 0 to 1 percent slopes
WeB	Webb fine sandy loam, 1 to 3 percent slopes
Za	Zapata soils
ZcA	Zavco sandy clay loam, 0 to 1 percent slopes
ZcB	Zavco sandy clay loam, 1 to 3 percent slopes
	Low Intensity *
BRB	Brackett and Real soils, undulating
BRE	Brackett and Real soils, hilly
ECB	Eckrant soils, undulating
EOB	Ector soils, undulating
ERE	Ector soils and Rock outcrop, hilly
HYB	Hindes and Yologo soils, undulating
LS	Limestone rock land
OLB	Olmos soils, undulating
OMB	Olmos and Ector soils, undulating
REB	Real and Eckrant soils, undulating
RRE	Rock land-Real association, steep

* The composition of these units is more variable than that of the other units in the county but has been controlled well enough to interpret for the expected use of the soils.

UVALDE COUNTY, TEXAS

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

- Divided
- Good motor
- Poor motor
- Trail

Highway markers

- National Interstate
- U. S.
- State, farm or county

Railroads

- Single track
- Multiple track
- Abandoned

Bridges and crossings

- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings

- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Corral

Well, oil or gas

Indian mound

Windmill

Recharge structure

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Fence
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line

- Perennial
- Intermittent

Streams, single-line

- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds

- Perennial (water, w)
- Intermittent (int)

Spring

Well, irrigation

Well, water

Drainage end or alluvial fan

RELIEF

Escarpments

- Bedrock
- Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

Soil boundary and symbol (Dx)

Gravel

Stoniness
- Stony
- Very stony

Rock outcrops

Chert fragments

Clay spot

Sand spot

Gumbo or scabby spot

Made land

Severely eroded spot

Blowout, wind erosion

Gully

Quarry (QU.)

Caliche pit (C.P.)

UVALDE COUNTY, TEXAS SHEET NUMBER 1

UVALDE COUNTY, TEXAS NO. 1

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1 650 000 FEET

655 000 FEET

EDWARDS COUNTY

KINNEY COUNTY

Creek

Maverick

Creek

Creek

Montell

Cedar

Creek

Sitter

Creek

(Joins sheet 2)

(Joins sheet 9)

1 675 000 FEET

1 640 000 FEET

N

2 Miles

10 000 Feet

5 000

0

1 000

2 000

3 000

4 000

5 000

UVALDE COUNTY, TEXAS — SHEET NUMBER 2

(2)

N

1 705 000 FEET

650 000 FEET

EDWARDS CO | REAL COUNTY

Lake Nueces

NUECES RIVER

Maverick Creek

(Joins sheet 1)

(Joins sheet 3)

(Joins sheet 10)

1 680 000 FEET

1 640 000 FEET

2 Miles 10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

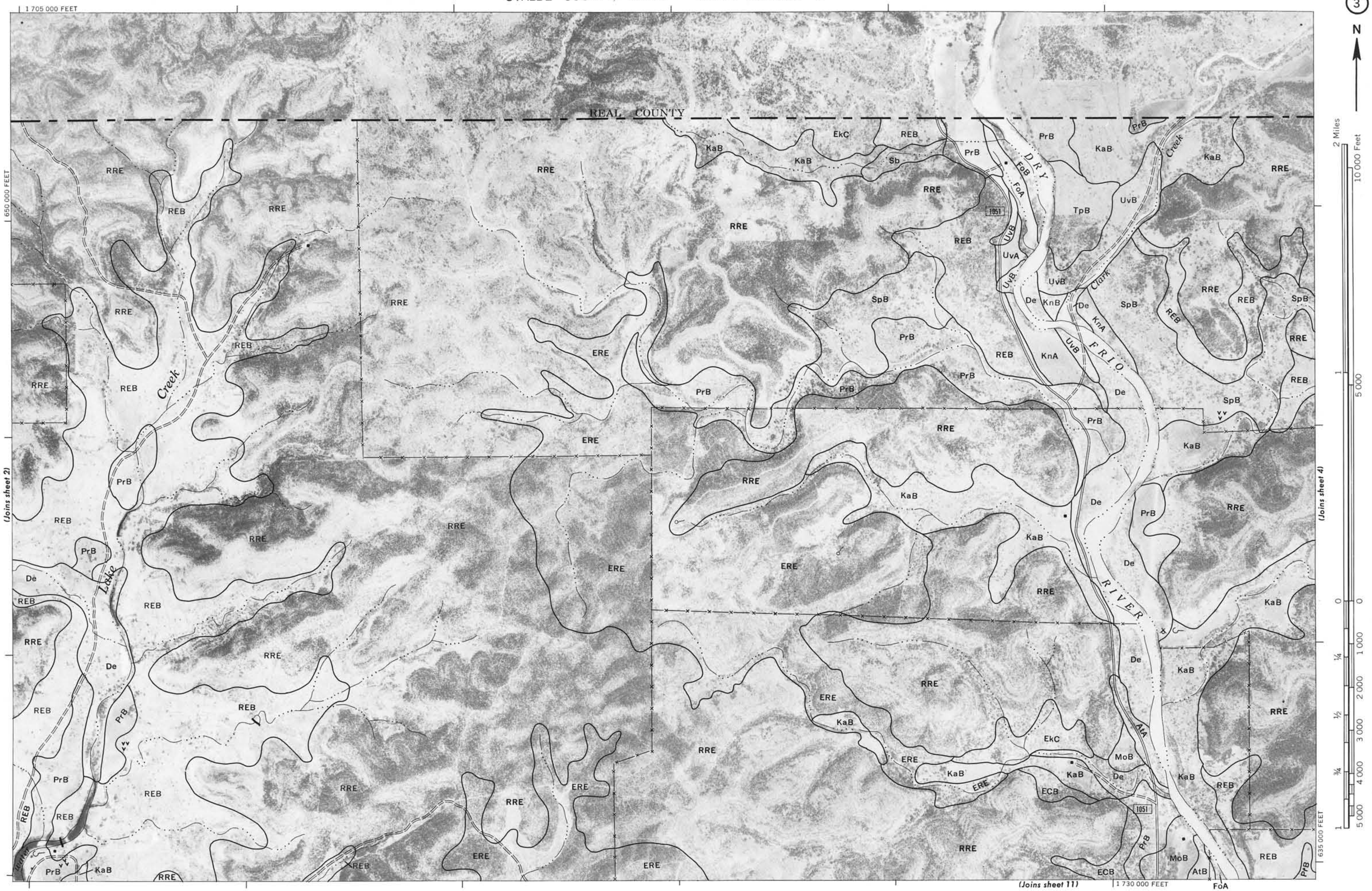
¾ 3 000

1 4 000

5 000

UVALDE COUNTY, TEXAS NO. 2

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

UVALDE COUNTY, TEXAS — SHEET NUMBER 4

(4)

N

2 Miles 10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000 FEET

1 760 000 FEET

650 000 FEET

635 000 FEET

1 735 000 FEET

REAL COUNTY

RIO GRANDE RIVER

GARNER STATE PARK

RRE
REB
ERE
KaB
SpB
AtA
AtB
Or
UvA
UvB
KnA
KnB
PrB
FoA
OLB
MoA
BRB
Fs
De

1050
83
53

(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 12)

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 4

UVALDE COUNTY, TEXAS NO. 5

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 765 000 FEET

650 000 FEET

REAL COUNTY

(Joins sheet 4)

(Joins sheet 6)

(Joins sheet 13)

1 790 000 FEET

635 000 FEET

GARNER STATE PARK

Magers Crossing

RIVER

Creek

Pailing

Cherry

Blanket

Bear

1050

5

N

2 Miles

10 000 Feet

1

5 000

0

1 000

2 000

3 000

4 000

5 000

N

2 Miles 10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000 5 000

1 820 000 FEET

650 000 FEET

635 000 FEET

1 795 000 FEET

REAL COUNTY

BANDERA COUNTY

(Joins sheet 5)

(Joins sheet 7)

(Joins sheet 14)

Creek

Blanket

Creek

Bear

Creek

Onion

Creek

Saltmarsh

Creek

1050

1050

RRE REB PrB BRE BRB KaB TpB FoB SpB CcA CcB VoB Or De FoA

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
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UVALDE COUNTY, TEXAS NO. 6

UVALDE COUNTY, TEXAS — SHEET NUMBER 7

UVALDE COUNTY, TEXAS NO. 7

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 825 000 FEET

650 000 FEET

635 000 FEET

1 850 000 FEET

BANDERA COUNTY

Utopia

SABINAL RIVER

Sabinal Creek

CREEK

LITTLE

(Joins sheet 6)

(Joins sheet 8)

(Joins sheet 15)

7

N

2 Miles

10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

8

N

1 880 000 FEET

650 000 FEET

635 000 FEET

1 855 000 FEET

2 Miles

10 000 Feet

5 000

1

5 000 4 000 3 000 2 000 1 000 0

¾ ½ ¼ 0

BANDERA COUNTY

MEDINA COUNTY

Seco Creek

Little Seco Creek

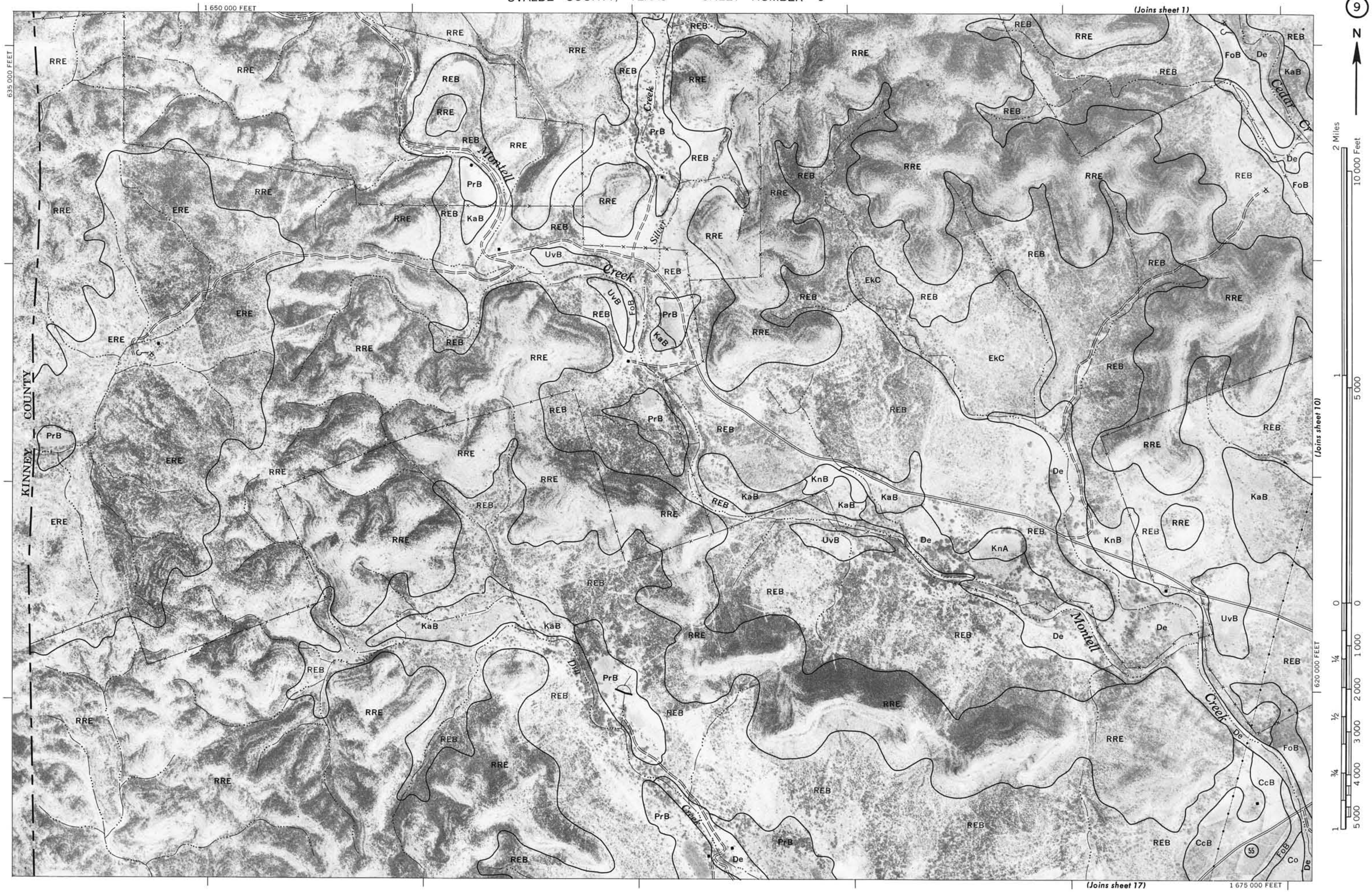
BRE RRE PrB SpB KaB Co AtB TpB REB

(Joins sheet 7)

(Joins sheet 16)

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 8



UVALDE COUNTY, TEXAS NO. 9

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

N

2 Miles

10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

(Joins sheet 2)

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 18)

1 705 000 FEET

635 000 FEET

620 000 FEET

1 680 000 FEET

Cedar Creek

Lake Creek

Blucher Creek

NUECES RIVER

Airstrip

Thomas Valley Ranch Headquarters

Witt Ranch Headquarters

London Ranch Headquarters

Mapleil

RRE REB PrB UvB AtB VaB FoB De Co KaB OLB KnB CcB ERE UvA REEB AtA SpB FoA Bo KnA

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
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UVALDE COUNTY, TEXAS — SHEET NUMBER 11

UVALDE COUNTY, TEXAS NO. 11

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Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 705 000 FEET

635 000 FEET

620 000 FEET

1 730 000 FEET

(Joins sheet 10)

(Joins sheet 3)

(Joins sheet 12)

(Joins sheet 19)

11

N

2 Miles

10 000 Feet

1 5 000 0

¼ 1 000 2 000

½ 3 000 4 000

¾ 5 000 0

1 0

Honey Creek

RIVER FRIO

DRY

Reagan Wells

1051

PrB KaB REB RRE ERE De MoB AtB ECB FoA OLB UvB MoA VaB KnB Sb SpB EkC

UVALDE COUNTY, TEXAS — SHEET NUMBER 12

12

N

2 Miles 10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000 5 000

(Joins sheet 4)

(Joins sheet 11)

(Joins sheet 13)

(Joins sheet 20)

1 735 000 FEET

1 760 000 FEET

620 000 FEET

635 000 FEET

GARNER STATE PARK

Elm Creek

Sycamore Cr.

SpB Creek

Fush Creek

DRY FRIO RIVER

Shut-In Hollow

1051

83

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 12

UVALDE COUNTY, TEXAS — SHEET NUMBER 13

UVALDE COUNTY, TEXAS NO. 13

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 765 000 FEET

635 000 FEET

(Joins sheet 5)

(Joins sheet 12)

(Joins sheet 14)

(Joins sheet 21)

1 790 000 FEET

615 000 FEET

13

N

2 Miles

10 000 Feet

5 000

1

0

1/4

1/2

3/4

1 000

2 000

3 000

4 000

5 000

GARNER STATE PARK

Magers Crossing

Peck Ranch Headquarters

Harrison Ranch Headquarters

Coffin Mountain

Seven Bluff

Elm Creek

Sycamore Creek

Bear Creek

Spring Creek

East Fork Bear Creek

Shut-in Hollow

Brushy Cr

FR 10

RIVER

PIT

83

N

2 Miles 10 000 Feet

1 5 000 0 0 1 000 ¼ 2 000 ½ 3 000 ¾ 4 000 1 5 000 FEET

(Joins sheet 6)

1 820 000 FEET

630 000 FEET

615 000 FEET

1 795 000 FEET

(Joins sheet 13)

(Joins sheet 15)

(Joins sheet 22)

Creek Spring Creek Creek Blanco Creek Brushy Creek Clark Ranch Headquarters Little Blanco Cr

RRE PrB REB De TpB KaB FoA BRE BRB SpB CcA ERE MoB LS ECB VoB PrB FoB

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
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UVALDE COUNTY, TEXAS NO. 14

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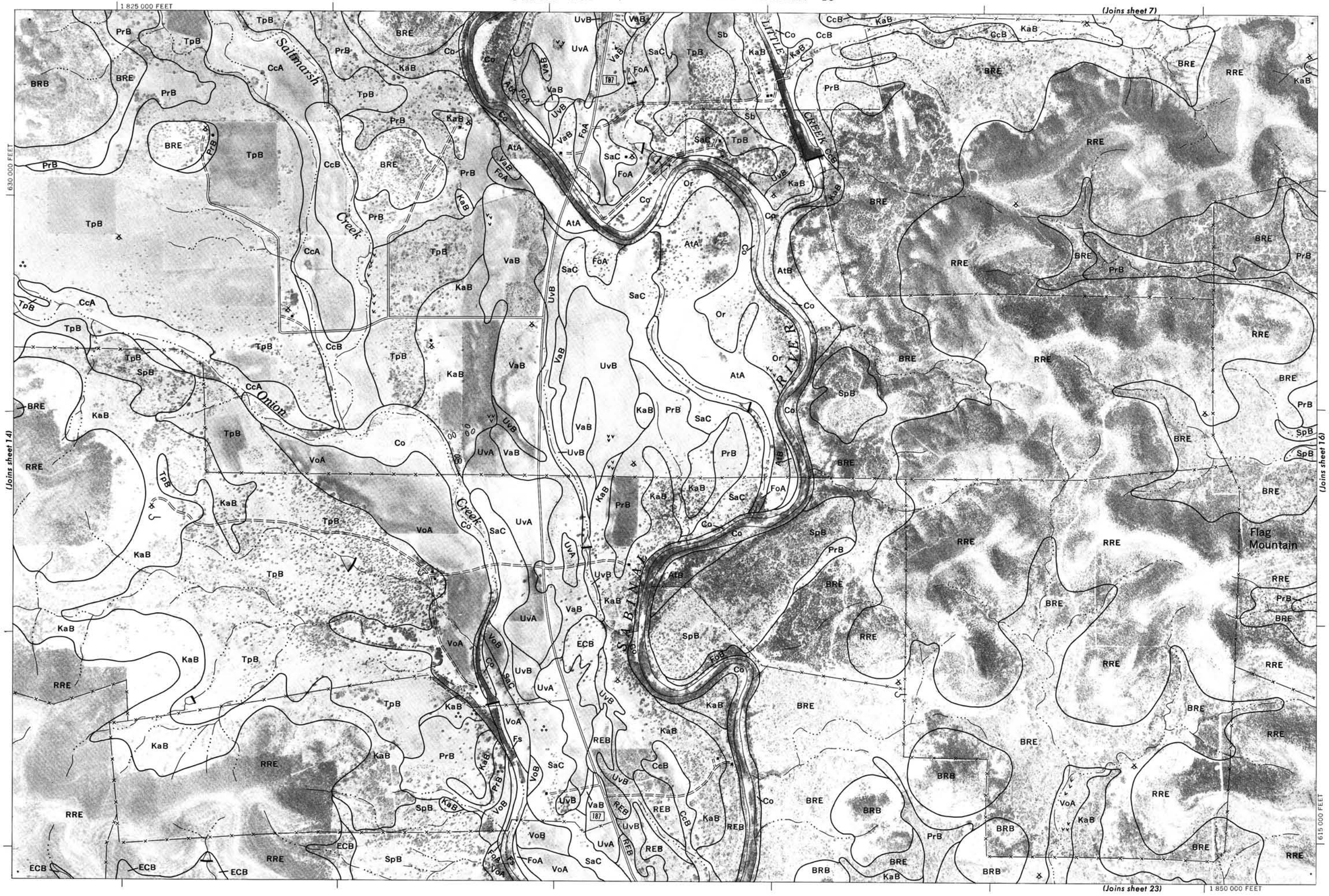
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.



(Joins sheet 8)

1 880 000 FEET

630 000 FEET

N

2 Miles 10 000 Feet

1 5 000 0 0 ¼ 1 000 ½ 2 000 ¾ 4 000 1 5 000

615 000 FEET

(Joins sheet 15)

(Joins sheet 24)

1 855 000 FEET

MEDINA COUNTY

Little Secos Creek

RRE BRE BRB REB KaB PrB SpB Sb ECB CcA MoB MoA

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
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UVALDE COUNTY, TEXAS NO. 16

UVALDE COUNTY, TEXAS NO. 17

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 650 000 FEET

615 000 FEET

(Joins sheet 9)

Boiling Mountain

KINNEY COUNTY

Dry Creek

NUECES R

Line Cat Cr

(Joins sheet 18)

(Joins sheet 25)

1 675 000 FEET

600 000 FEET

17

N

2 Miles

10 000 Feet

1

5 000

0

1 000

¼

2 000

½

3 000

¾

4 000

1

5 000

(18)

N

2 Miles
10 000 Feet
1 5 000
0 0
¼ 1 000
½ 2 000
¾ 3 000
4 000
5 000

(Joins sheet 10)

1 705 000 FEET

615 000 FEET

600 000 FEET

(Joins sheet 17)

(Joins sheet 19)

(Joins sheet 26)

1 680 000 FEET

NUECES RIVER

Miller Creek

Sycamore Creek

NUECES R

De, KnB, KaB, PrB, REB, RRE, FoB, ERE, FoA, Co, KnA, AtB, EOB, UvB, ECB, LS

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
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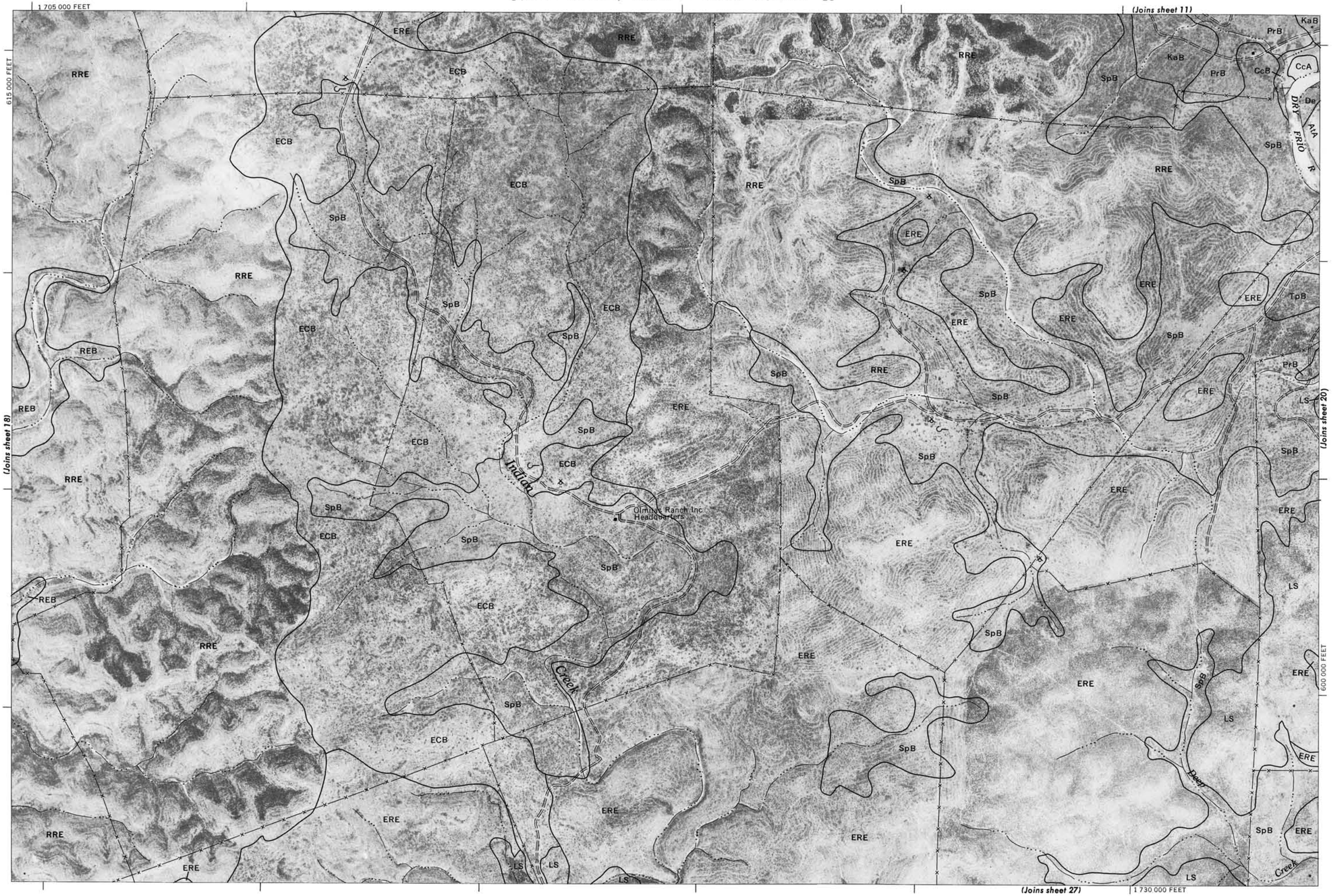
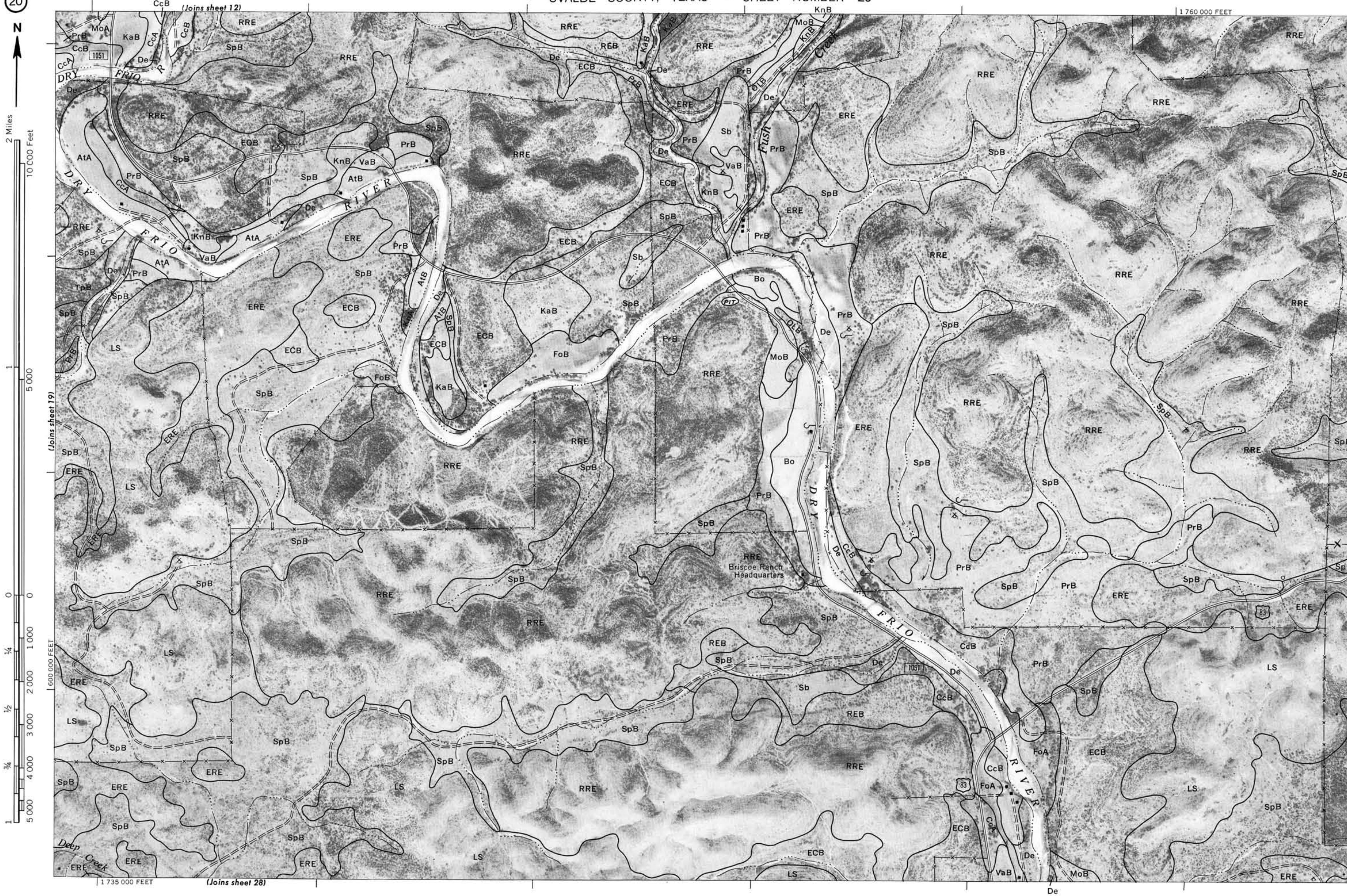
UVALDE COUNTY, TEXAS NO. 18

UVALDE COUNTY, TEXAS NO. 19

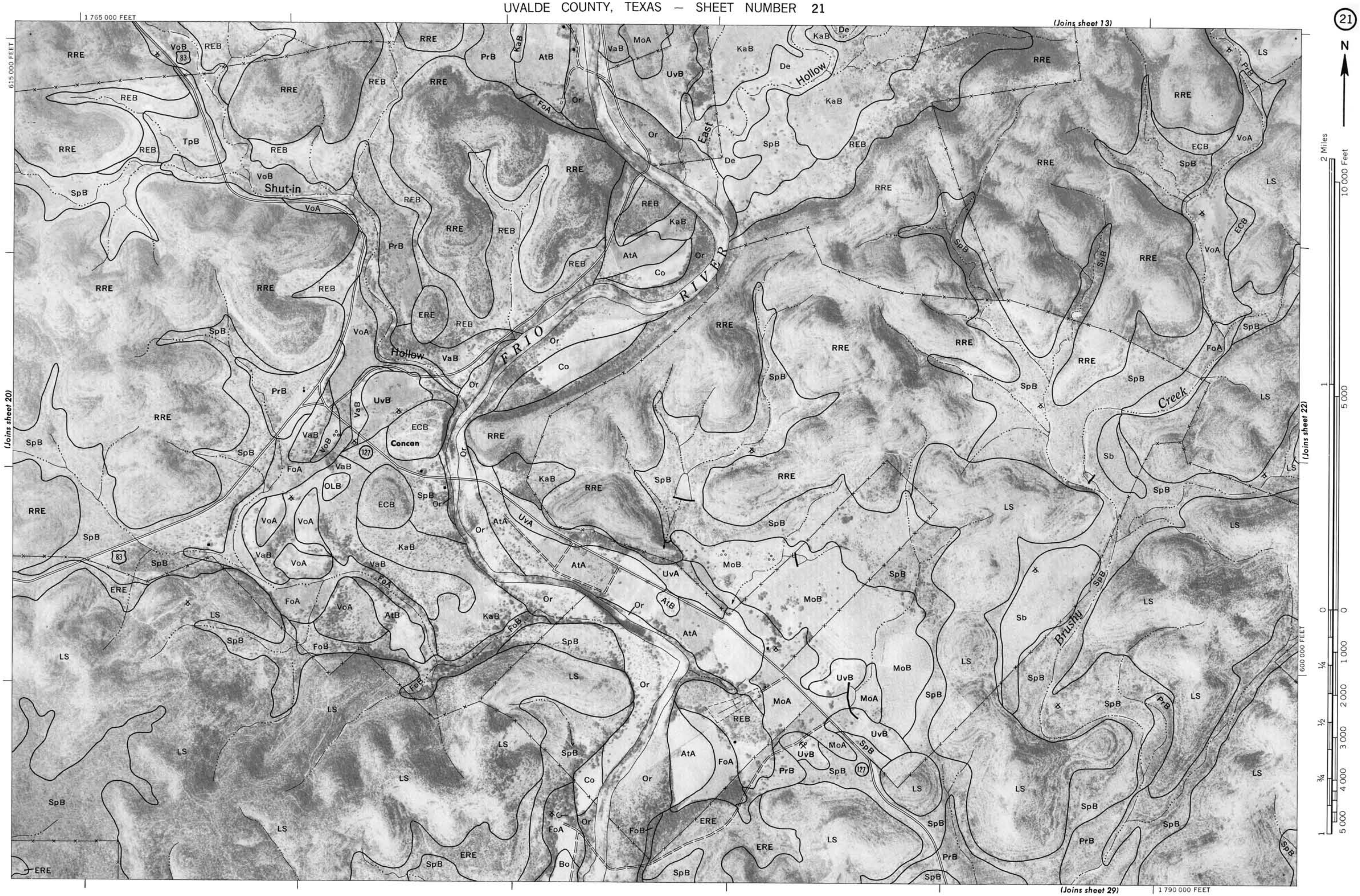
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.





Photobase from 1971 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 20



UVALDE COUNTY, TEXAS NO. 21

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

UVALDE COUNTY, TEXAS — SHEET NUMBER 22

22

N

(Joins sheet 14)

1 820 000 FEET

610 000 FEET

(Joins sheet 21)

600 000 FEET

1 795 000 FEET

(Joins sheet 30)

(Joins sheet 23)

2 Miles 10 000 Feet

1 5 000

¾ 4 000

½ 3 000

¼ 2 000

0 1 000 0

McNair Ranch Headquarters

Bald Mountain

Little Blanco Creek

BLANCO CREEK

Hackberry Creek

Pecan Hollow

Ringtail Mountain

LS ERE REB FcA PrB De KaB FoB MoB VoB VoA VaB SpB ECB TpB RRE MoA

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
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UVALDE COUNTY, TEXAS NO. 22

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 825 000 FEET

610 000 FEET

(Joins sheet 15)

(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 31)

1 850 000 FEET

595 000 FEET

23

N

2 Miles

10 000 Feet

1

5 000

0

1 000

¼

2 000

½

3 000

¾

4 000

1

5 000

Orion

Little Blanco Creek

Creek

SABINAL RIVER

Airstrip

187

UVALDE COUNTY, TEXAS — NUMBER 24

(24)

N

2 Miles 10 000 Feet

1 5 000

0 0 1 000

¼ 2 000

½ 3 000

¾ 4 000

1 5 000 FEET

(Joins sheet 16)

(Joins sheet 23)

(Joins sheet 32)

1 855 000 FEET

595 000 FEET

1 880 000 FEET

610 000 FEET

MEDINA COUNTY

Holy Mountain

Little Seco Creek

Comanche Creek

Hamilton Creek

RRE BRB BRE PrB CcA KaB REB SpB ECB LS TpB ToA MoA KnA Me

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 24

UVALDE COUNTY, TEXAS NO. 25

COUNTY, TEXAS — SHEET NUMBER 25

25

N

1 650 000 FEET

595 000 FEET

580 000 FEET

(Joins sheet 17)

(Joins sheet 26)

(Joins sheet 33)

1 675 000 FEET

KINNEY COUNTY

Live Oak Creek

WEST NUECES RIVER

NUECES R

OMB

BRE

RRE

OLB

334

54

55

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

2 Miles 10 000 Feet

1 5 000

¼ 2 000

½ 3 000

¾ 4 000

1 5 000

0 0

1 000

UVALDE COUNTY, TEXAS — SHEET NUMBER 26

(26)

N

2 Miles

10 000 Feet

1 : 5 000

0 1/4 1/2 3/4 1

1 000 2 000 3 000 4 000 5 000 FEET

0 0

(Joins sheet 18)

(Joins sheet 25)

(Joins sheet 27)

(Joins sheet 34)

1 700 000 FEET

595 000 FEET

580 000 FEET

1 675 000 FEET

Round Mountain

Sycamore Mountain

Miller Creek

NUECES RIVER

De Creek

Sycamore Creek

Laguna

55

334

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 26

UVALDE COUNTY, TEXAS — SHEET NUMBER 27

27

UVALDE COUNTY, TEXAS NO. 27

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 705 000 FEET

595 000 FEET

(Joins sheet 19)

(Joins sheet 26)

(Joins sheet 28)

(Joins sheet 35)

580 000 FEET

1 730 000 FEET

N

2 Miles

10 000 Feet

1 5 000

½ 0 1 000 2 000 3 000

¼ 0

¾ 5 000 4 000

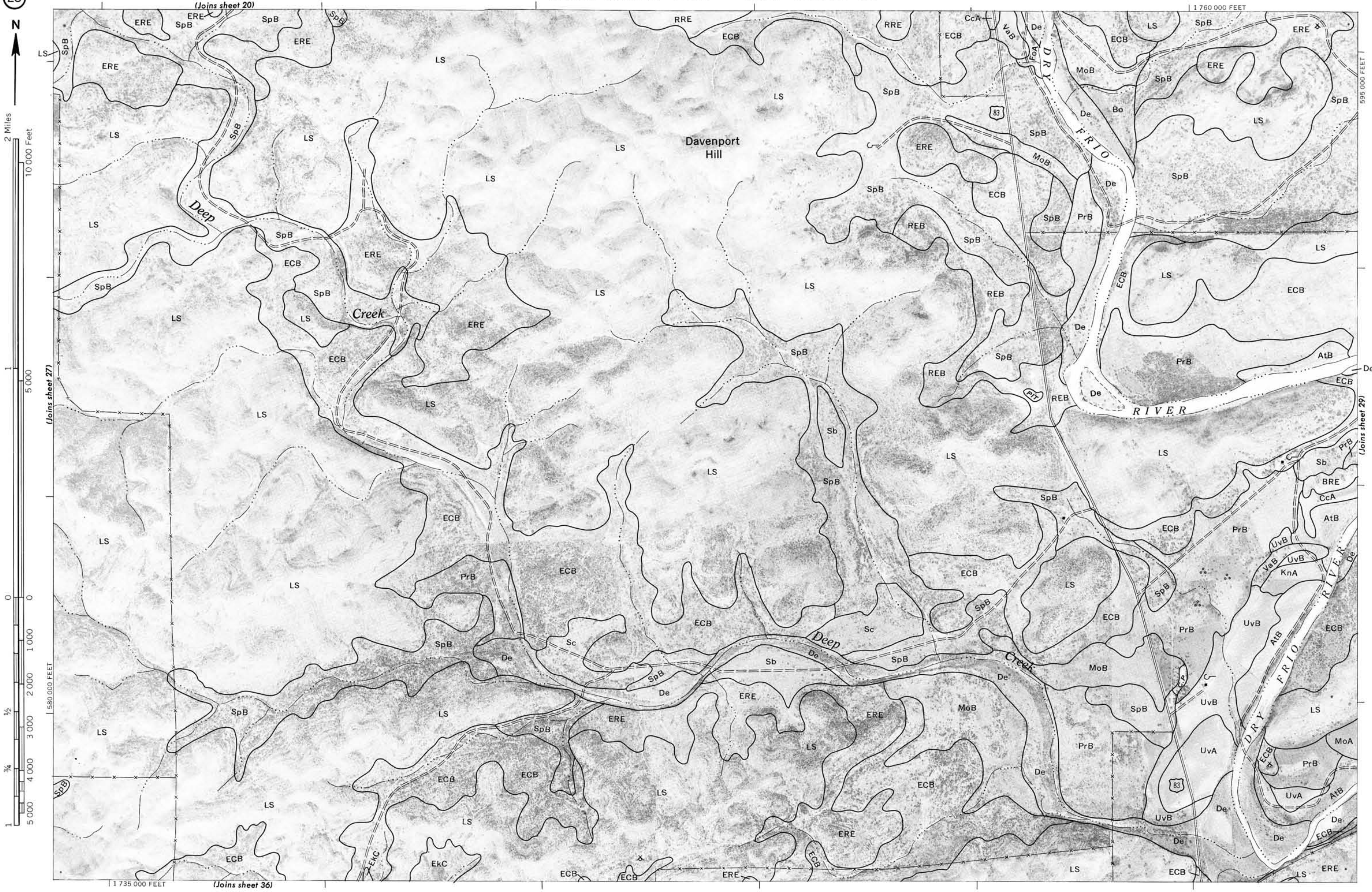
Indian Creek

Deep Cr

Mason Ranch Headquarters

Dunbar Ranch Headquarters

RRE ERE LS SpB Sb ECB KaB EOB REB De FoB



Photobase from 1971 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
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UVALDE COUNTY, TEXAS – SHEET NUMBER 30

30

N

2 Miles

10 000 Feet

1 | 5 000

(Joins sheet 22)

(Joins sheet 29)

(Joins sheet 31)

(Joins sheet 38)

1 820 000 FEET

595 000 FEET

580 000 FEET

1 795 000 FEET

1 : 5 000 | ¼ | ½ | ¾ | 1 | 0 | 0 | 1 000 | 2 000 | 3 000 | 4 000 | 5 000

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
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UVALDE COUNTY, TEXAS NO. 30

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

(Joins sheet 24)

1 880 000 FEET

590 000 FEET

580 000 FEET

1 855 000 FEET

(Joins sheet 31)

(Joins sheet 40)

N

2 Miles 10 000 Feet

1 5 000 0

¾ 4 000 0

½ 3 000 1 000

¼ 2 000

0 1 000

Ranchero Creek

Comanche Creek

Rancheros Creek

1796

MEDINA COUNTY

REB SpB ToA MoA KnA TpB PrB KaB OLB UvA VaB Me KnB

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 32

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

(Joins sheet 26)

1 700 000 FEET

575 000 FEET

N

2 Miles

10 000 Feet

1 5 000

5 000 0 0

1 000 2 000 3 000 4 000 5 000

¼ ½ ¾ 1

560 000 FEET

(Joins sheet 33)

(Joins sheet 35)

1 675 000 FEET

(Joins sheet 42)

French Creek

Long Hollow

NUECES RIVER

UvA UvB VaB OLB FoA FoB AtB SaC Co ERE EOB REB LS De PrB KnA Fs SpB ToB MoA EkC

334 55

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 34

UVALDE COUNTY, TEXAS NO. 35

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 705 000 FEET

575 000 FEET

(Joins sheet 27)

(Joins sheet 34)

(Joins sheet 36)

(Joins sheet 43)

1 730 000 FEET

560 000 FEET

Indian Creek

Elm Slough

Indian Creek

Ranch Headquarters

35

N

2 Miles

10 000 Feet

1 5 000 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

N

2 Miles 10 000 Feet

1 5 000

(Joins sheet 28)

(Joins sheet 35)

(Joins sheet 37)

(Joins sheet 44)

1 760 000 FEET

575 000 FEET

560 000 FEET

1 735 000 FEET

Green Mountain

Leona River

Dry Frio R.

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 37

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

N

2 Miles 10 000 Feet

1 5 000

(Joins sheet 30)

(Joins sheet 37)

(Joins sheet 39)

(Joins sheet 46)

1 820 000 FEET

575 000 FEET

560 000 FEET

1 795 000 FEET

RIO GRANDE RIVER

Hackberry Creek

Blanco Creek

Dimmit Creek

Little Blanco Creek

1049

127

De ERE UvA UvB KnA KnB MoA MoB ToA FoA Fs Me Co VaB VoA VoB VoB OLB ECB SpB SaC OMB CcA AtB HYB

0 1 000 2 000 3 000 4 000 5 000

¼ ½ ¾ 1

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 39

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 825 000 FEET

575 000 FEET

(Joins sheet 31)

(Joins sheet 38)

(Joins sheet 40)

(Joins sheet 47)

1 850 000 FEET

560 000 FEET

39

N

2 Miles

10 000 Feet

1 5 000

¼ 1 000

½ 2 000

¾ 3 000

0 4 000

0 5 000

Notton Creek

SABINAL RIVER

CALICHE PIT

127 187 30 AIA

(40)

N

2 Miles 10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

1 5 000

(Joins sheet 32)

(Joins sheet 39)

(Joins sheet 48)

1 880 000 FEET

575 000 FEET

560 000 FEET

1 855 000 FEET

Elm Creek

Elm Creek

MEDINA COUNTY

OLB UvA VaB KaB PrB SpB REB KnA MoA UvB KnB HYB

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 40

UVALDE COUNTY, TEXAS NO. 41

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 650 000 FEET

555 000 FEET

540 000 FEET

1 670 000 FEET

(Joins sheet 33)

(Joins sheet 42)

(Joins sheet 49)

KINNEY — UVALDE COUNTY

WEST NUECES RIVER

WEST NUECES RIVER

WEST NUECES RIVER

41

N

2 Miles

10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

4 000

5 000

UVALDE COUNTY, TEXAS — SHEET

42

N

2 Miles

10 000 Feet

1 : 5 000 | 0 | ¼ 1 000 | ½ 2 000 | ¾ 4 000 | 1 5 000

(Joins sheet 34)

1 700 000 FEET

595 000 FEET

540 000 FEET

1 675 000 FEET

(Joins sheet 41)

(Joins sheet 43)

(Joins sheet 50)

NUECES RIVER

Chalk Bluff

Big Draw

Slough

Elm

HABY CROSSING

55

EOB ERE LS REB OLB UvA UvB VaB AtA AtB CcA CcB De Co Fs SpB SpA EkC PrB TpB ToA ToB MoA Za KnA FoA OMB

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 42

UVALDE COUNTY, TEXAS NO. 43

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 705 000 FEET

555 000 FEET

540 000 FEET

1 730 000 FEET

(Joins sheet 35)

(Joins sheet 42)

(Joins sheet 44)

(Joins sheet 51)

Slough

Elm Creek

Indian Creek

Little Elm Creek

Cooks Slough

43

N

2 Miles

10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

(Joins sheet 36)

(Joins sheet 43)

(Joins sheet 45)

(Joins sheet 52)

1 760 000 FEET

555 000 FEET

540 000 FEET

1 735 000 FEET

N

2 Miles 10 000 Feet

1 5 000

1/4 1 000

1/2 2 000

3/4 3 000

1 4 000

5 000 0

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 44

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 765 000 FEET

555 000 FEET

(Joins sheet 44)

(Joins sheet 37)

(Joins sheet 46)

(Joins sheet 53)

1 790 000 FEET

540 000 FEET

Black Mountain

Stough

Taylor

RIO FRIO RIVER

DRY RIO FRIO RIVER

2690

45

N

2 Miles

10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

N

2 Miles 10 000 Feet

1 5 000 0 1 000 2 000 3 000 4 000 5 000

1/4 1/2 3/4

(Joins sheet 38)

(Joins sheet 45)

(Joins sheet 47)

(Joins sheet 54)

1 820 000 FEET

555 000 FEET

540 000 FEET

1 795 000 FEET

Blanco Cr

Dinner Creek

Blanco Creek

FRIO RIVER

PACIFIC SOUTHERN

1049

90

Pit

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 47

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 825 000 FEET

555 000 FEET

(Joins sheet 39)

(Joins sheet 46)

(Joins sheet 48)

(Joins sheet 55)

1 850 000 FEET

540 000 FEET

47

N

2 Miles

10 000 Feet

5 000

1

0

1 000

¼

2 000

½

3 000

¾

4 000

5 000

1

Sabinal

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 48

UVALDE COUNTY, TEXAS — SHEET NUMBER 49

UVALDE COUNTY, TEXAS NO. 49

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 645 000 FEET

535 000 FEET

520 000 FEET

1 670 000 FEET

(Joins sheet 41)

(Joins sheet 50)

(Joins sheet 57)

KINNEY COUNTY

WEST NUECES RIVER

Mustang Waterhole

SOUTHERN PACIFIC

49

N

2 Miles

10 000 Feet

1 5 000 0

¼ 1 000

½ 2 000

¾ 3 000

4 000

5 000

UVALDE COUNTY, TEXAS — SHEET NUMBER 50

(50)

N

2 Miles 10 000 Feet

1 5 000

(Joins sheet 42)

(Joins sheet 49)

(Joins sheet 51)

(Joins sheet 58)

1 700 000 FEET

535 000 FEET

520 000 FEET

1 675 000 FEET

WEST NUECES RIVER

NUECES RIVER

Elm Slough

SOUTHERN PACIFIC

EOB TpB De OmB KnA SaC FoA UvB MoA OMB VaB Bo KnB PrB ToB ToA CcA CcB CaA AtA AtB ERE Co OLB UvA IgC

0 0 1/4 1 000 1/2 2 000 3/4 3 000 4 000 5 000 1 5 000

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 50

UVALDE COUNTY, TEXAS NO. 51

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

52

UVALDE COUNTY, TEXAS — SHEET NUMBER 52

N

2 Miles 10 000 Feet

1 5 000 0 1 000 2 000 3 000 4 000 5 000

¼ ½ ¾

(Joins sheet 44)

1 760 000 FEET

535 000 FEET

520 000 FEET

1 735 000 FEET

(Joins sheet 51)

(Joins sheet 53)

(Joins sheet 60)

Eightmile Waterhole

Recharge Structure

Irrigation Reservoir

Irrigation Reservoir

Frio River

Leona Slough

Taylor Slough

Cooks Slough

Broom Slough

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 52

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

N

1 765 000 FEET

535 000 FEET

(Joins sheet 52)

(Joins sheet 45)

(Joins sheet 54)

(Joins sheet 61)

520 000 FEET

1 790 000 FEET

Black Mountain

Blue Mountain

Taylor Slough

PACIFIC

SOUTHERN

DRY FRIO RIVER

FRIO RIVER

QUARRY

CALICHE PIT

2369

90

90

SpB KnB KnA MoA MoB OMB OLB Me InD IgC VaB UvA UvB EOB LS De Or AtA AtB SaC CcA Co ToA ERE

2 Miles
10 000 Feet
5 000
1
¼
½
¾
0
1 000
2 000
3 000
4 000
5 000

(54)

N

2 Miles

10,000 Feet

1 | 5,000

0 | 0

¼ | 1,000

½ | 2,000

¾ | 3,000

1 | 4,000

5,000

(Joins sheet 46)

(Joins sheet 53)

(Joins sheet 55)

(Joins sheet 62)

1 820 000 FEET

535 000 FEET

520 000 FEET

1 795 000 FEET

Knippa

PACIFIC SOUTHERN

Dimmer Cr

Blanco Creek

FRIO RIVER

PIT

AtB AtA UvA Co FoA De Or KnA KnB MoA OLB Me UvB CcA Fs SaC ToA VaB InD IgC

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 55

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

55

N

2 Miles
10 000 Feet
1
5 000
0
1 000
2 000
3 000
4 000
5 000
¼
½
¾
1

(Joins sheet 48)

1 880 000 FEET

535 000 FEET

520 000 FEET

1 855 000 FEET

(Joins sheet 55)

(Joins sheet 64)

N

2 Miles

10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

1 5 000

Irrigation Reservoir

Elm Creek

Fs Creek

Ranchero

SABINAL RIVER

int

COUNTY

MEDINA

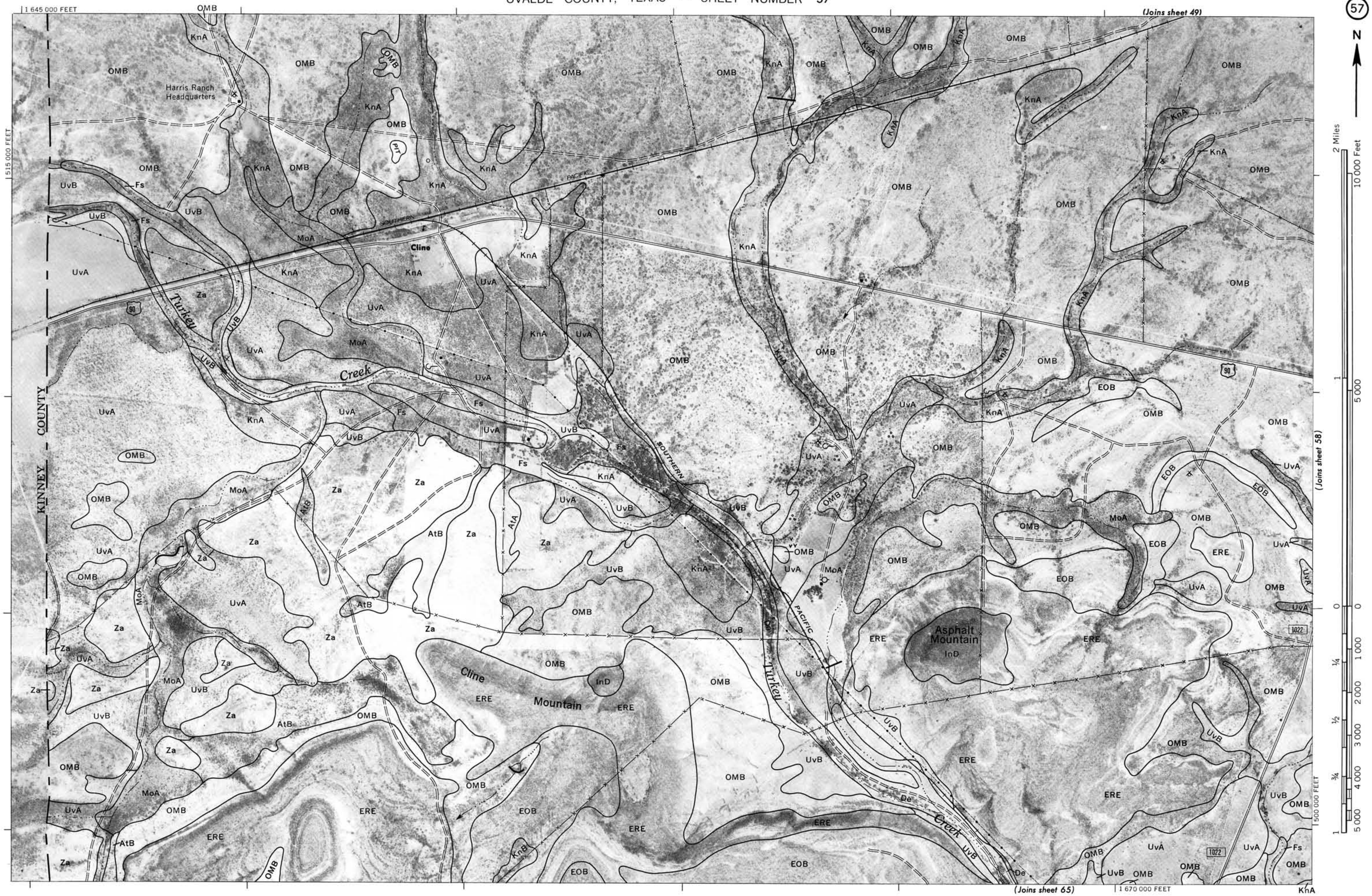
187

KnA KnB VaB UvA UvB SaC FoA OLB AtA AtB Co CcB Fs

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 56

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.



N

2 Miles 10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

1 700 000 FEET

1 675 000 FEET

515 000 FEET

500 000 FEET

(Joins sheet 50)

(Joins sheet 57)

(Joins sheet 59)

(Joins sheet 66)

NUECES R

PACIFIC SOUTHERN

Obi Hill

Cantrell Mountain

Nueces Hill

Slough

Wood

PIT

KnA KnB OMB EOB ToA ToB De SpB MoA IgC InD UvA UvB VaB AtB Me Fs ERE

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 59

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 705 000 FEET

515 000 FEET

(Joins sheet 58)

(Joins sheet 51)

(Joins sheet 60)

(Joins sheet 67)

1 730 000 FEET

500 000 FEET

59

N

2 Miles

10 000 Feet

1 5 000

¼ 1 000 2 000

½ 3 000 4 000

¾ 5 000

0 0

SOUTHERN PACIFIC

NUECES RIVER

Irrigation Reservoir

1403

2369

90

55

C.P.

AtA AtB Bo Co De FoA Fs HYB IgC InD KnA KnB Me MoA MoB OLB OMB Or ToA UvA UvB VaB

UVALDE COUNTY, TEXAS — SHEET NUMBER 60

60

N

2 Miles 10 000 Feet

1 5 000

(Joins sheet 59)

(Joins sheet 52)

1 760 000 FEET

515 000 FEET

(Joins sheet 61)

1 735 000 FEET

(Joins sheet 68)

500 000 FEET

0 0

¼ 1 000 2 000

½ 3 000

¾ 4 000

1 5 000

Cooks Slough

Slough

Boon Me

Irrigation Reservoir

Irrigation Reservoir

Irrigation Reservoir

River

Leona

Slough

Cooks

Slough

Taylor

SOUTHERN PACIFIC

SOUTHERN PACIFIC

UVALDE (county seat)

GARNER AIRFIELD

KnA KnB MoA MoB MB OLB VaB OMB UvA UvB ToA ToB Me Bd EOB De CcA CcB FoA FoB Fs SaC SpB InD AtB ERE PIT OMB

1403 55 83 2369 1574 1023 862 90 112 1052 1435

C.P.

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 60

UVALDE COUNTY, TEXAS NO. 61

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

(Joins sheet 60)
(Joins sheet 53)
(Joins sheet 62)
(Joins sheet 69)

1 765 000 FEET
1 790 000 FEET
515 000 FEET
500 000 FEET

61

N

2 Miles
10 000 Feet
1
5 000
0
1 000
2 000
3 000
4 000
5 000

SOUTHERN PACIFIC
2369
1023
90
FRIO RIVER
Black Waterhole
PIT
Southwest Texas Junior College

KnA KnB MoA MoB OMB OLB UvA UvB VaB InD IgC ToA ToB Me HYB FoA Co De AtA AtB CcA CcB Fs SaC ZcB EOB

62

UVALDE COUNTY, TEXAS — SHEET NUMBER 62

N

2 Miles — 10 000 Feet

1 — 5 000

0 — 0

¼ — 1 000

½ — 2 000 — 500 000 FEET

¾ — 3 000

1 — 4 000

1 — 5 000

(Joins sheet 54)

(Joins sheet 61)

(Joins sheet 63)

(Joins sheet 70)

1 820 000 FEET

515 000 FEET

1 795 000 FEET

1023

1049

Me

Dimmer Creek

Long Hollow

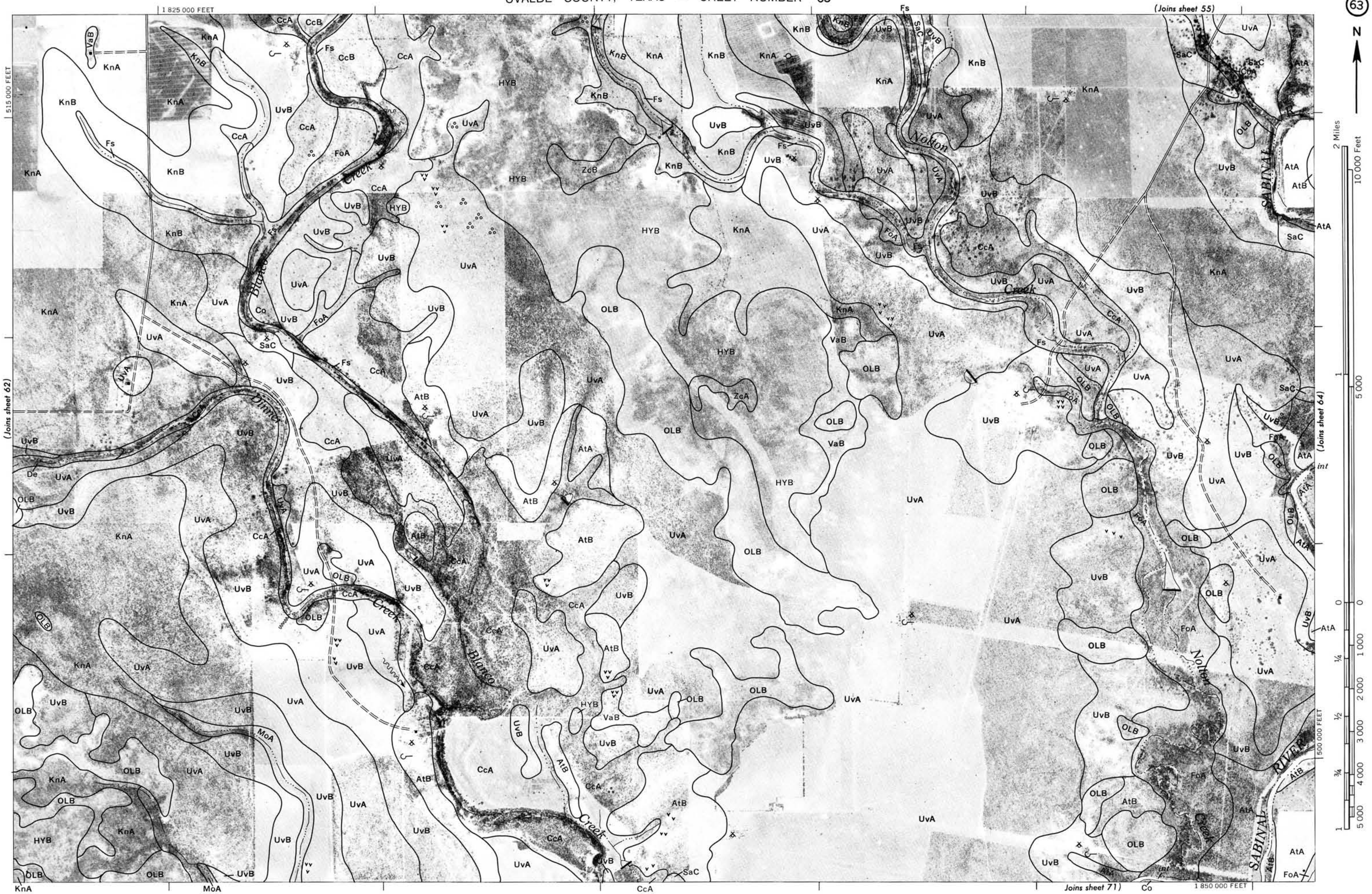
CcA CcB De HYB InD IgC KnA KnB MoA OLB ToA UvA UvB VaB

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 62

UVALDE COUNTY, TEXAS NO. 63

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.



N

2 Miles 10 000 Feet

1 5 000

0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000

(Joins sheet 56)

1 880 000 FEET

515 000 FEET

500 000 FEET

1 855 000 FEET

(Joins sheet 72)

(Joins sheet 63)

Ranchero Ct

int

SABINAL RIVER

Pilot Knob

InD

C.P

187

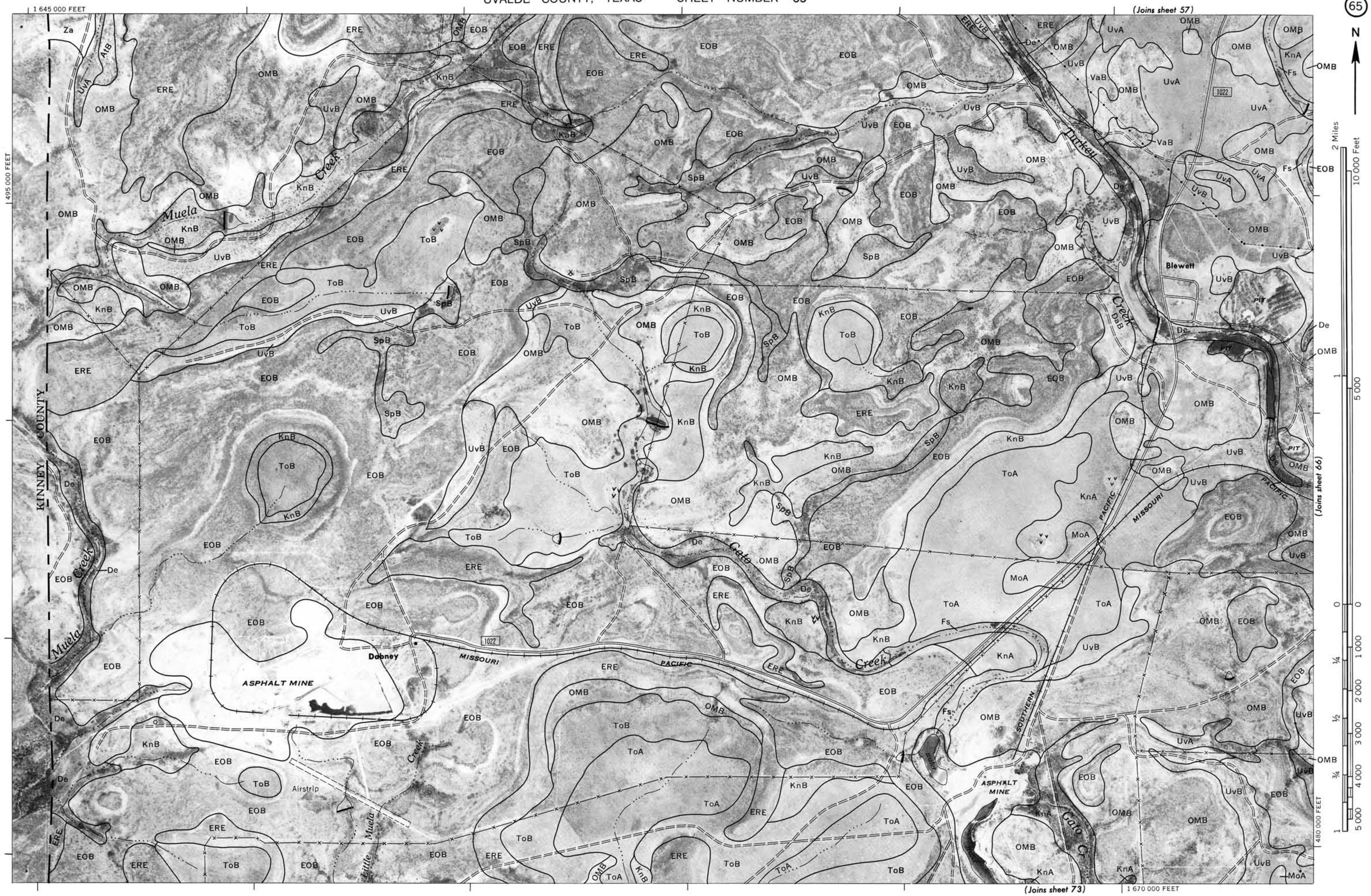
COUNTY

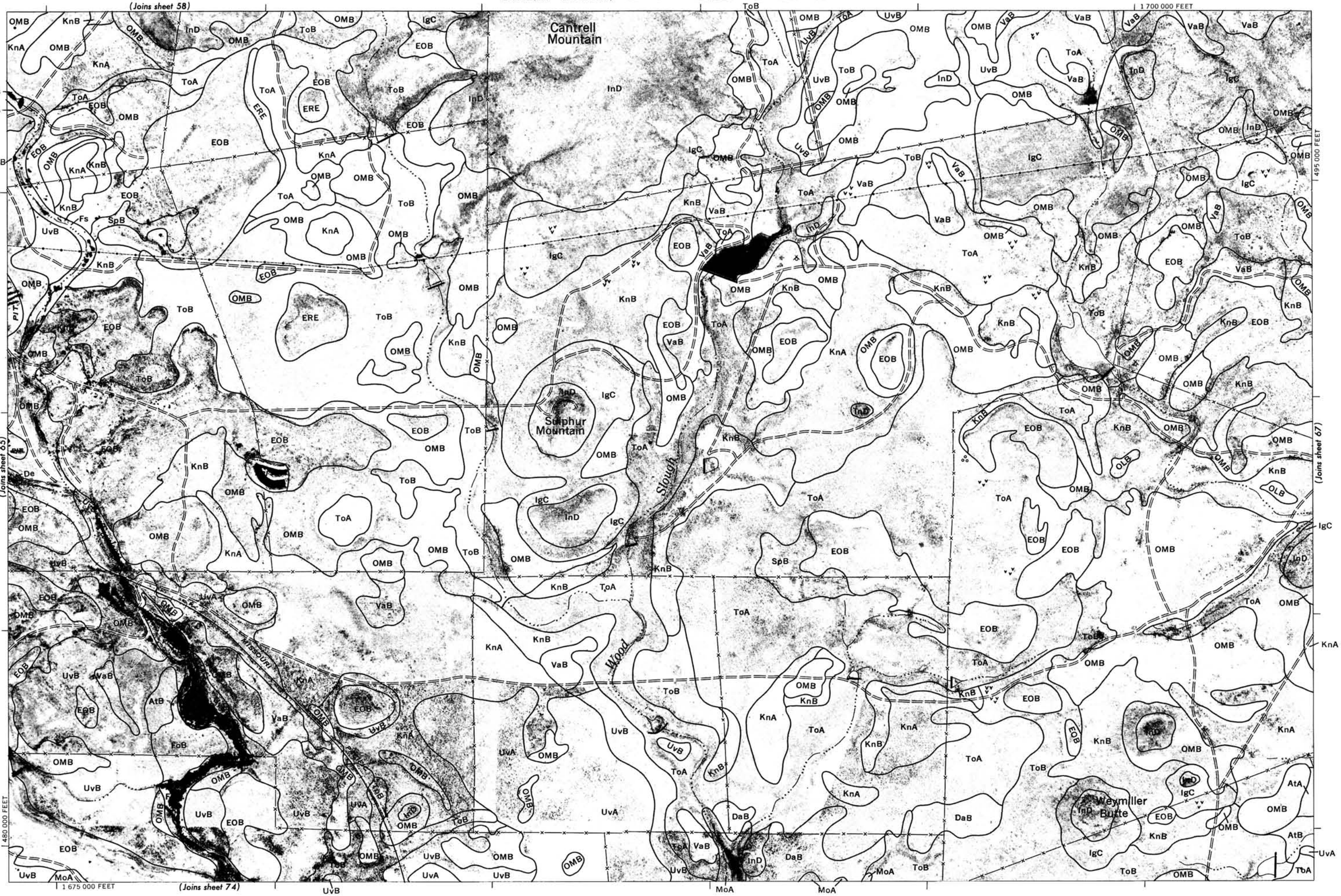
MEDINA

AtA AtB Co DaB FoA IgC KnA MoA OLB RhB SaC ToA UvA UvB VaB

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.





Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 66

UVALDE COUNTY, TEXAS — SHEET NUMBER 67

UVALDE COUNTY, TEXAS NO. 67

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 705 000 FEET

495 000 FEET

480 000 FEET

1 730 000 FEET

(Joins sheet 59)

(Joins sheet 66)

(Joins sheet 68)

(Joins sheet 75)

67

N

2 Miles

10 000 Feet

1

5 000

0

1 000

¼

2 000

½

3 000

¾

4 000

1

5 000

NUECES RIVER

Elm Creek

Tom Nunn Hill

Fish Hatchery

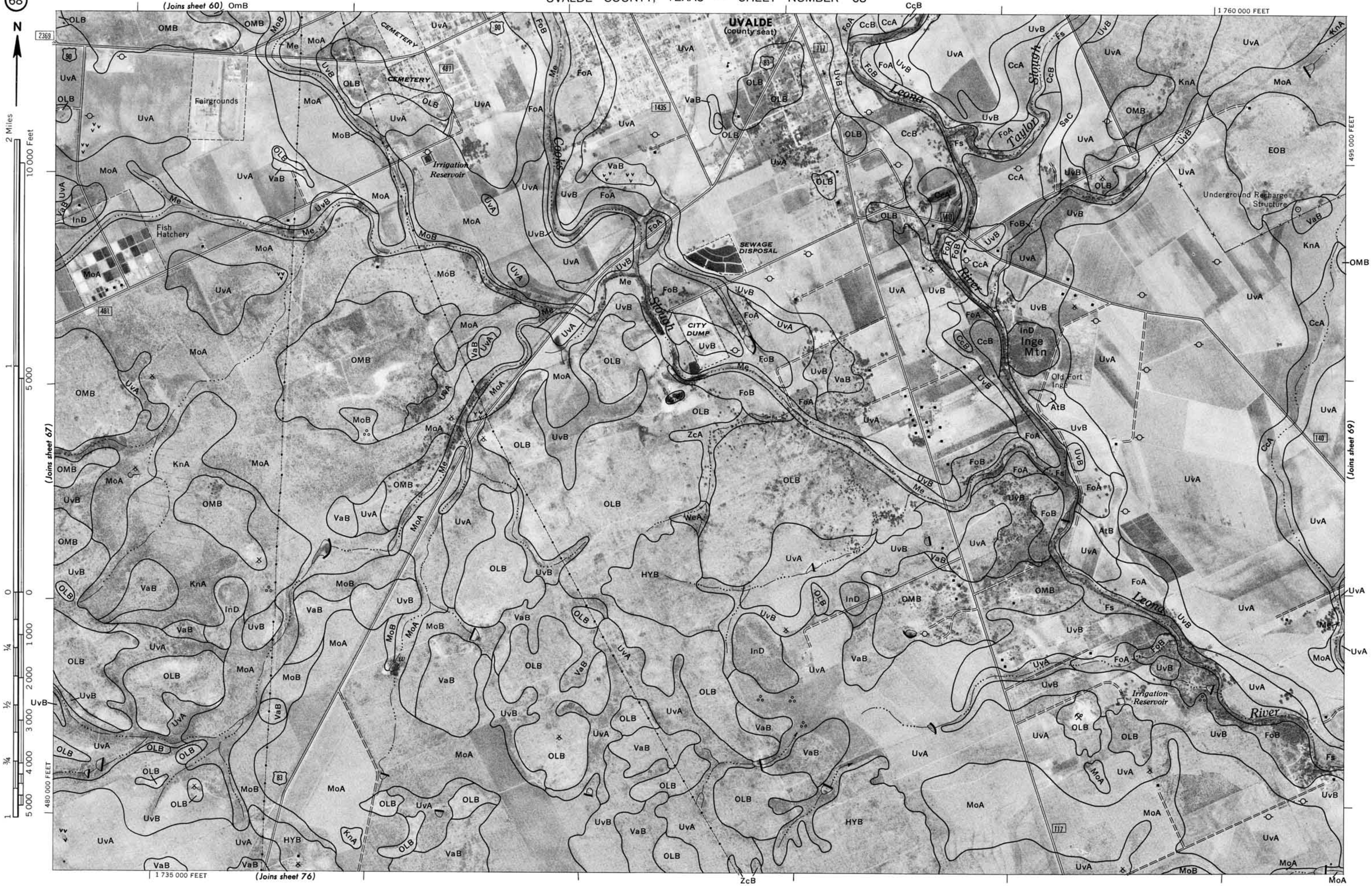
water

481

2369

90

UVALDE COUNTY, TEXAS — SHEET NUMBER 68



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

Photobase from 1971 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

UVALDE COUNTY, TEXAS NO. 69

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 765 000 FEET

495 000 FEET

(Joins sheet 61)

(Joins sheet 68)

(Joins sheet 70)

(Joins sheet 77)

1 790 000 FEET

480 000 FEET

FRIO RIVER

Leona River

140

2 Miles
10 000 Feet
1
5 000
0
0
¼
1 000
½
2 000
¾
3 000
1
4 000
5 000

UVALDE COUNTY, TEXAS — SHEET NUMBER 70

(70)

N

(Joins sheet 62)

1 820 000 FEET

495 000 FEET

480 000 FEET

1 795 000 FEET

(Joins sheet 69)

(Joins sheet 71)

(Joins sheet 78)

Irrigation Reservoir

FRIO RIVER

Long Hollow

2 Miles

10 000 Feet

5 000

1

0

¼

½

¾

1

5 000

4 000

3 000

2 000

1 000

0

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 70

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

N

2 Miles

10 000 Feet

1

5 000

(Joins sheet 63)

(Joins sheet 70)

(Joins sheet 72)

(Joins sheet 79)

Blanco Creek

Long Hollow

FRIO R

SABINAL RIVER

Blanco Creek

187

187

KnA HYB OLB UvA UvB MoA CcA SaC AtB CaB VaB Co FoA RhB Me

(Joins sheet 64)

1 880 000 FEET

495 000 FEET

N

2 Miles

10 000 Feet

5 000

0

1 000

2 000

3 000

4 000

5 000

480 000 FEET

1 855 000 FEET

(Joins sheet 71)

(Joins sheet 80)

MEDINA COUNTY

Irishman Hill

AtA AtB CcA CcB DuB FoA HYB OLB RdB RhB UvA UvB VaB ZcA ZcB

187

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
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UVALDE COUNTY, TEXAS NO. 72

UVALDE COUNTY, TEXAS NO. 73

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

74

N

(Joins sheet 66)

1 700 000 FEET

475 000 FEET

(Joins sheet 75)

(Joins sheet 73)

1 675 000 FEET

(Joins inset A, sheet 81)

460 000 FEET

2 Miles

10 000 Feet

1 : 5 000

0 1/4 1/2 3/4 1

0 1 000 2 000 3 000 4 000 5 000

BIG TANK

Irrigation Reservoir

MISSOURI PACIFIC

Wood Slough

Turkey Creek

Wagon Top

Mustang Creek

Windmill Cr.

UVALDE COUNTY, TEXAS NO. 74

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 75

compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
se from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

75
N
(Joins sheet 67)
(Joins sheet 74)
(Joins sheet 76)
(Joins sheet 81)

1 705 000 FEET
475 000 FEET
460 000 FEET
1 730 000 FEET

2 Miles
10 000 Feet
1
5 000
0
0
1 000
¼
2 000
½
3 000
¾
4 000
1
5 000

Elm Creek
NUECES RIVER
Smyth Crossing
Mustang Creek
481
M P
4

UVALDE COUNTY, TEXAS — SHEET NUMBER 76

(76)

N

(Joins sheet 68)

1 760 000 FEET

475 000 FEET

(Joins sheet 77)

1 735 000 FEET

460 000 FEET

(Joins sheet 82)

(Joins sheet 75)

2 Miles

10 000 Feet

1 5 000 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000 0

Camp Lake

Slough

Live Oak

C.P.

TRACK

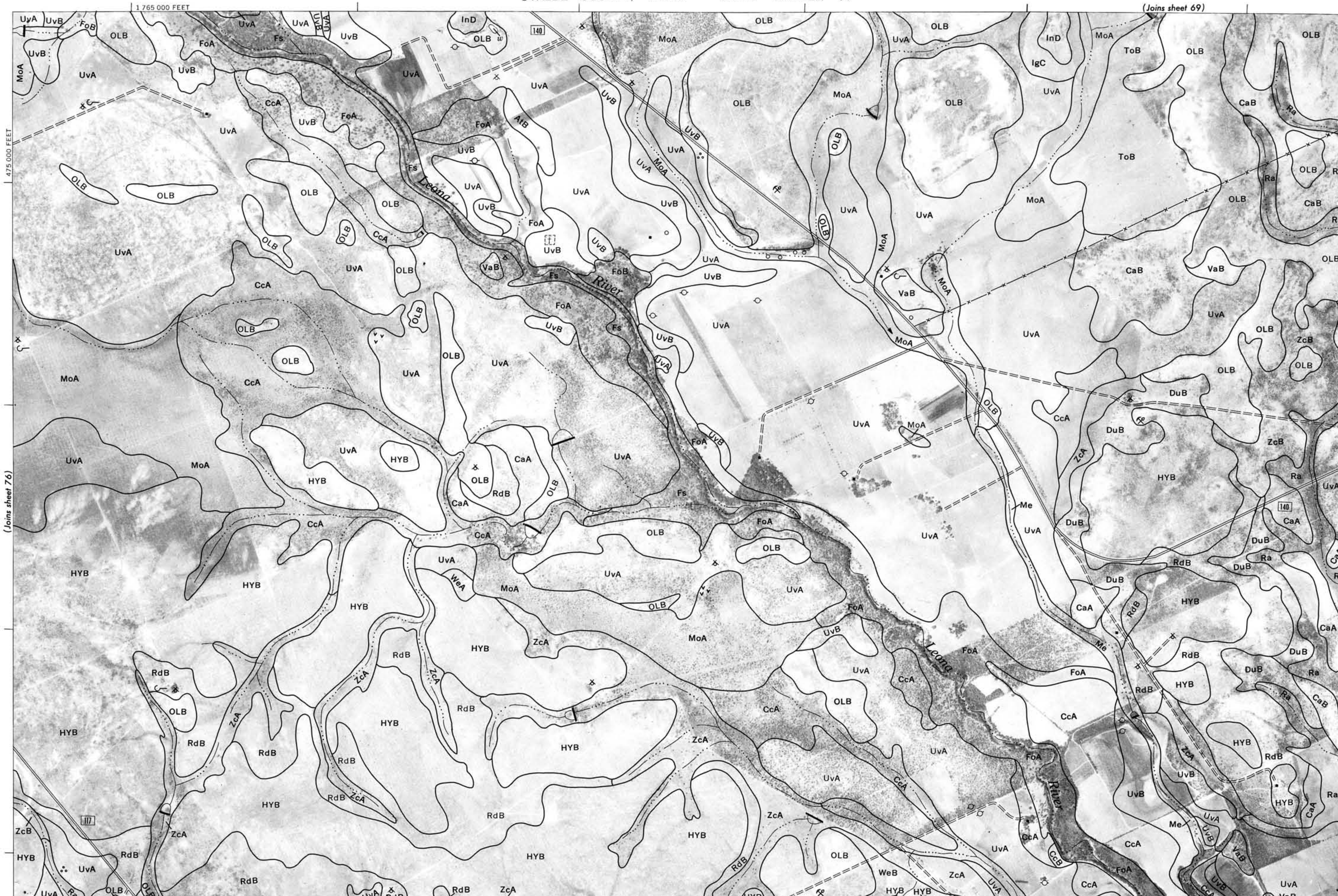
TEST

117

83

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 76



UVALDE COUNTY, TEXAS NO. 77

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

N

2 Miles 10 000 Feet

1 5 000

1 0 0

¼ 1 000

½ 2 000

¾ 3 000

1 4 000

5 000 460 000 FEET

(Joins sheet 70)

(Joins sheet 77)

(Joins sheet 79)

(Joins inset B, sheet 82)

1 820 000 FEET

475 000 FEET

1 795 000 FEET

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 78

UVALDE COUNTY, TEXAS — SHEET NUMBER 79

UVALDE COUNTY, TEXAS NO. 79

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

1 825 000 FEET

475 000 FEET

460 000 FEET

1 850 000 FEET

(Joins sheet 71)

(Joins sheet 78)

(Joins sheet 80)

(Joins sheet 83)

79

N

2 Miles

10 000 Feet

1

5 000

0

1 000

¼

2 000

½

3 000

¾

4 000

1

5 000

Frank Kincaid Ranch Headquarters

RIO FRIO RIVER

SABINAL RIVER

Blanco Creek

FRIO RIVER

187

140

(Joins sheet 72)

1 880 000 FEET

475 000 FEET

N

2 Miles

10 000 Feet

1 5 000

(Joins sheet 79)

Woodley Ranch Headquarters

SABINAL RIVER

Blanco Creek

FRIO RIVER

MEDINA COUNTY

187

460 000 FEET

1 855 000 FEET

(Joins inset, sheet 83)

HYB
ZcB
RdB
CcA
AtA
OLB
UvA
VaB
UvB
AtB
Me
CcB
DuB

1 5 000 0 0
¼ 1 000
½ 2 000
¾ 3 000
1 4 000
5 000

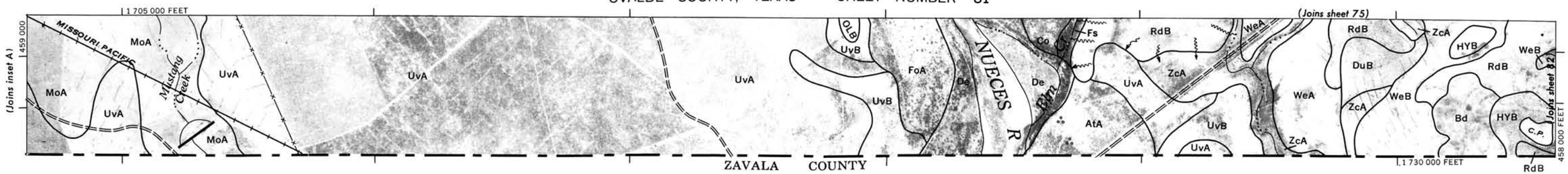
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 80

UVALDE COUNTY, TEXAS — SHEET NUMBER 81

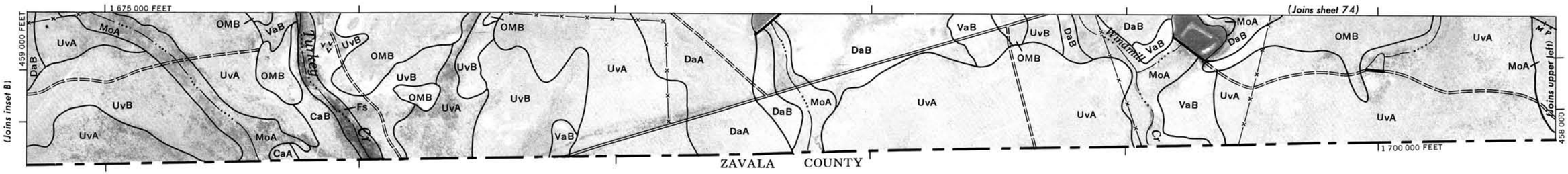
81

N



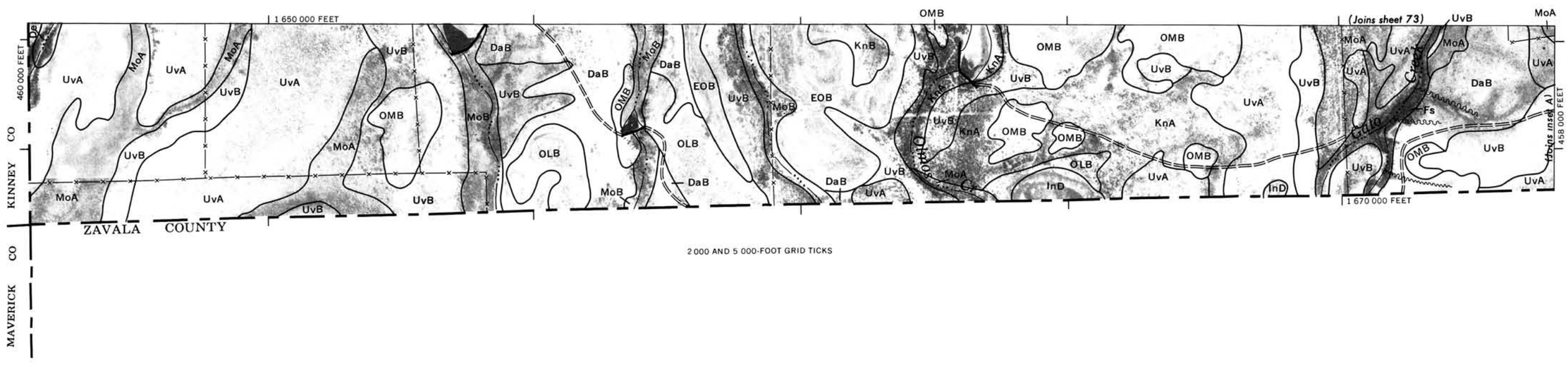
1 000 AND 5 000-FOOT GRID TICKS

INSET A



1 000 AND 5 000-FOOT GRID TICKS

INSET B



2 000 AND 5 000-FOOT GRID TICKS

2 Miles
10 000 Feet
1
5 000
0
1 000
¼
2 000
½
3 000
¾
4 000
1
5 000

UVALDE COUNTY, TEXAS NO. 81

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station. Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.

UVALDE COUNTY, TEXAS — SHEET NUMBER 82

82

N

2 Miles

10 000 Feet

(Joins sheet 81)

457 000 FEET

1 735 000 FEET

(Joins sheet 76)

1 760 000 FEET

459 000 FEET

(Joins inset A)

ZAVALA COUNTY

2 000 AND 5 000-FOOT GRID TICKS

INSET A

1

5 000

(Joins upper right)

457 000 FEET

(Joins sheet 77)

1 765 000 FEET

1 790 000 FEET

459 000 FEET

(Joins inset B)

ZAVALA COUNTY

2 000 AND 5 000-FOOT GRID TICKS

INSET B

0

0

¼

1 000

½

2 000

(Joins inset A)

457 000 FEET

3 000

¾

4 000

1

5 000

(Joins sheet 78)

1 795 000 FEET

1 820 000 FEET

459 000 FEET

(Joins sheet 83)

ZAVALA COUNTY

2 000 AND 5 000-FOOT GRID TICKS

Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.

UVALDE COUNTY, TEXAS NO. 82

UVALDE COUNTY, TEXAS — SHEET NUMBER 83

UVALDE COUNTY, TEXAS NO. 83

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, and the Texas Agricultural Experiment Station.
Photobase from 1971 aerial Photography. Positions of 5,000 foot grid ticks are approximate and based on the Texas coordinate system, south central zone.